# FOOD INSPECTION NOTES

## A HANDBOOK FOR STUDENTS

BY

H. HILL, F.R.San.I., F.S.I.A., A.M.I.S.E.
SANITARY INSPECTOR, BOROUGH OF SOUTHGATE
"OLLETT" GOLD MEDALLIST

AND

E. DODSWORTH, M.R.San.I., ~~M.S.I.A.~~
SANITARY INSPECTOR, BOROUGH OF EDMONTON

AGRICULTURAL C
COIMBATORE
46257

LONDON
H. K. LEWIS & Co. Ltd.
1943

AGRICULTURAL COLLEGE
-4257-
1 JUN 1967
COIMBATORE

# FOOD INSPECTION NOTES

*Made and Printed in Great Britain*

# PREFACE

THE aim of this small volume is to meet what has long been considered by the authors a definite necessity and it has been designed with that end in view. Public health students have long had to delve into many weighty though excellent volumes and sift the grain from the chaff to extract the knowledge which they seek in order to pass essential examinations. Similarly, the qualified and experienced official often requires to be reminded in a speedy manner of an essential point of food inspection work and he will, it is hoped, find much to interest him in the pages which follow.

The authors, being practising public health officers, have on many occasions experienced similar difficulties and this work is the outcome. They hope that this volume will serve the purpose they have in mind and will be received for exactly what it is intended to be, namely, a condensation of present day knowledge of foods and their inspection, clearly presented and stripped of all superfluous matter.

PUBLIC HEALTH DEPT.,
TOWN HALL, N.13. H. HILL.

PUBLIC HEALTH DEPT.,
TOWN HALL, N.9. E. DODSWORTH.

*June*, 1943.

# CONTENTS


| | PAGE |
|---|---|
| **MEAT INSPECTION** | 1 |
| Ante-mortem Inspection | 1 |
| Slaughterhouses | 3 |
| Slaughtering and Dressing | |
| Inspection of Carcases | 8 |
| Anatomy and Physiology | 9 |
| Diseases of Food Animals | 23 |
| Glossary of Important Terms | 23 |
| Physiological Conditions | 25 |
| Inflammatory Diseases | 26 |
| Blood Diseases | 30 |
| Bacterial Diseases | 32 |
| Diseases due to Fungi and Viruses | 38 |
| Suppurative Diseases | 40 |
| Parasitic Diseases | 41 |
| Degenerative Conditions | 48 |
| Accidental Death | 48 |
| Imported Meat | 49 |
| By-products of Meat | 50 |
| Preservation of Meat | 53 |
| **POULTRY** | 56 |
| **RABBITS** | 60 |
| **GAME** | 62 |
| **FISH** | 63 |
| **SHELLFISH** | 76 |
| **MILK** | 80 |
| **MILK PRODUCTS** | 89 |
| **CANNED FOODS** | 98 |
| **OTHER FOODS** | 100 |
| **FOOD POISONING** | 111 |
| **FOOD SAMPLING** | 114 |
| **INDEX** | 118 |

# FOOD INSPECTION NOTES

## MEAT INSPECTION

### ANTE-MORTEM INSPECTION

**Objects**

Examination of live animal important. Assists in :

(1) Detection and isolation of diseased animals.

(2) Avoidance or prevention of transmission of disease from animal to man by infection of persons engaged in slaughtering or in handling meat.

(3) Observation of conditions requiring more rigorous examination after slaughter and assistance in attaining this object.

(4) Obviously diseased animals can be excluded from any insurance scheme which may be in force in a district.

**Appearance of Animal**

Live animals should be well nourished ; alert, coat loose, soft, free moving on underlying structures ; hair smooth with slight lustre ; nostrils healthy, no discharge. Tongue not protruding ; animal rises easily ; firm in flesh. Ill or lame animals shunned by their fellows. Animal's head resting on ground when lying down indicates illness. Ruminant animals never lie on their sides when well. If ailing, coat rough and hidebound with bare patches. Respiration, pulse and temperature are indications of state of health.

SYMPTOMS. Signs of disease in live animals.

LESIONS. Signs of disease in dead animals.

**Respiration**

Frequency and character indicated by rise and fall of flanks ; should be even and regular ; muzzle cool, no discharge. Breath should be odourless. If flanks heaving and respiration rate increased, animal said to be " blowing " ; nostrils are distended. Respirations more frequent in young animals. With shallow respiration, rise and fall of flanks reduced ; frequency increased. In estimating rate of respiration, following to be considered :

(1) Character of animal.

(2) Incidence of exercise.

(3) Age.

(4) Atmospheric conditions.

Animals with respiratory diseases breathe rapidly and flanks heave; also cough and noisy respirations.

**Pulse**

Means of ascertaining strength and frequency of heart beats. Denotes animal's strength. Observed on artery having hollow or bony background. Extremities best for testing. Pulse always in sympathy with respirations. In illness, frequent and weak. Usually taken from submaxillary artery on lower edge of jaw. Inside for horses and outside or on tail for cattle. Sheep and pigs, taken from femoral artery inside thigh.

**Temperature**

Extremities and limbs just perceptibly warm to hand, muzzle always cool. Coldness of extremities denotes weak circulation and heart action. Warm muzzle, ears, horns and hooves denote fever. Taken by thermometer inserted in rectum.

TABLE 1

*Respiration Rate, Pulse and Temperature for Various Domestic Animals*

| | Respiration per minute. | Pulse per minute. | Temperature. |
|---|---|---|---|
| Oxen . . . | 12–15 | 40 | 101·5° F. |
| Horse . . . | 8–10 | 35 | 101·0° F. |
| Sheep . . . | 12–30 | 75 | 104·0° F. |
| Pig . . . | 12–30 | 75 | 102·0° F. |
| Calf . . . | 15–20 | 50 | 101·5° F. |

**Digestion**

Healthy animals eat and drink greedily. If ill, eat little; may refuse to drink. Cud chewing noticeable in normal animals; ceases or delayed when ill. Dung should be of normal consistency, unmixed with blood; no unpleasant smell. Dung thin and watery when bowels inflamed or digestive troubles. Blown or enlarged stomach noticeable.

**Urine**

Urine clear yellow in colour. Thick and muddy urine with disagreeable smell indicates bladder trouble.

### Generative Organs

Healthy animals, vagina closed ; no discharge ; whitish mucous membrane ; no sores. Whitish discharge may be present if animal diseased. Foul smelling discharge indicates retention of placenta.

### Udder

Firm in heifers. In cows, distended and soft. Udder distended when inflammatory conditions present ; hot and painful when handled. Fluid may escape from teats.

### Injuries

Injured animal often refuses to rise, particularly if bones broken.

## SLAUGHTERHOUSES

### Abattoirs

Should be regarded as *essential for all large districts or for* combination of smaller districts. Provided in all large towns and many smaller areas.

SITE. Adjoining railway and good access by road. On outskirts of town.

SIZE. According to number of animals to be slaughtered.

PLAN. (1) Lairage.

(2) Slaughter rooms. Separate for oxen, sheep and pigs.

(3) Hanging or cooling rooms.

(4) Cold store.

(5) Meat detention room with condemned meat store and laboratory.

(6) Tripery and gut-scraping premises.

(7) By-products and fat digesting premises.

(8) Manure store with movable containers.

(9) Offices and lavatories.

(10) Messrooms and lavatories.

(11) Boiler house.

Good water supply, lighting and drainage essential. Most colonial and foreign countries now provide abattoirs in all large centres of population.

Advantages are :

Centralisation, greater ease and efficiency of inspection, suitable storage of carcases, utilisation of by-products, ease of access.

### Private Slaughterhouses

Still in majority in this country. Some built on sound hygienic lines, majority entirely unsatisfactory, provide poor

accommodation for slaughtering, meat storage and inspection. Difficult to keep clean, many too near dwelling houses; nuisances from noise and smell. Access through congested or busy public thoroughfares. Inspection rendered difficult on account of number of slaughterhouses and times of slaughter. All such premises should be abolished.

## SLAUGHTERING AND DRESSING

### General

Before slaughter, animal should be rested for at least twelve hours; if travelled long distance, two or three days. Water should be supplied in abundance and animal given quietness and induced to rest. Objects of resting are to get rid of wasting due to recent activities. Allows for healing of bruises and enables animal to bleed properly. Fatigued animals bleed badly and flesh does not keep so well as that from rested animals. Loss of weight due to transport over period of twenty-four hours may equal 10 per cent. Loss increased in hot weather. Main points to remember in slaughtering are:

(1) Speed.
(2) Humanity.
(3) Safety of personnel.
(4) Complete bleeding of animal.

### Stunning

With certain exceptions, must be carried out by means of mechanically-operated instruments. Main advantages:

(1) Lack of cruelty.
(2) More speedy as animal is quieter.

Main objections raised:

(1) Bleeding not so complete—doubtful.
(2) Danger of accident when free bullet is employed.

Several types of instrument:

(1) GREENERS.

Consists of short rifled barrel taking small steel-pointed bullet, finished with bell-shaped chamber which deadens sound, protects operator from flash, and directs bullet through brain into spinal cord. Made to be employed either at front or at side.

(2) CASH.

Common type in use. Captive bolt, no free bullet. Made in form of pistol, charge propels steel rod or bolt into brain of animal. Rod or bolt travels 2 inches;

does not leave barrel entirely. Temple Cox pistol is constructed on similar lines.

(3) SWEDISH.

Uses bullet fired by tap of mallet. Leather mask covering eyes and forehead of animal, sometimes used. In centre of this is shield-like plate with metal tube receiving striking bolt or pin with pointed head. Struck with wooden mallet to fire bullet.

(4) ELECTRICAL STUNNING.

Normally employed on pigs (see page 6). Can be readily adapted for slaughter of cattle and horses but has not been so employed in this country.

### Stunning and Bleeding

In stunning, point aimed at is intersection of lines drawn from each horn base to eye on opposite side. Bullet or captive bolt enters skull and penetrates deeply into brain ; if properly carried out produces immediate and complete insensibility. Pithing cane introduced through hole thus made and passed completely through brain for some distance down spinal cord ; medulla destroyed by violent movement inwards and outwards. Animal them bled. Straight cut made through skin of chest and knife is passed through opening towards chest wall until large vein at this point is opened. Blood emerges in strong stream and is usually collected for further use. Bleeding assisted by pumping by pressure of foot on flanks.

### Jewish Method

Method permitted by Slaughter of Animals Act, 1933. Animal thrown to ground by ropes and pulleys, or Weinberg casting pen employed. Fettered so that head rests on horns and nose. Rabbi then severs throat ; incision goes through all structures down to vertebræ. Claimed that anæmia of brain and consequent unconsciousness sets in immediately. Meat passed by Rabbi termed "Kosher." If lungs and chest wall are free from adhesions, carcase passed ; if slightest adhesion exists, meat not used as "Kosher" meat. Objections to this method are :

(1) Animal is conscious until throat is cut.

(2) Animal has to be roughly handled in throwing unless casting pen is used.

(3) Blood wasted as stomach contents become mixed with same.

Jewish fraternity normally use only forequarters of animal

as food. Hindquarters can only be used if freed from large blood vessels.

### Calves

Previously hoisted up, head downwards, by rope fixed round hind legs, stunned and throat cut. Claimed that carcase bleeds better this way. Must now be stunned before hanging. Head is finally removed entirely to assist complete bleeding.

### Sheep

Placed on wooden crutch or creal ; three legs tied together, one being allowed free to kick and expel blood. Knife inserted into nape of neck and spinal cord severed or neck broken by sharp backward twist of head. Slaughter of Animals Act, 1933, allows local authority to require the stunning of sheep in their area prior to insertion of knife. Most local authorities have made use of these permissive powers. The "*Definite*" sheep stunner is made on lines of captive bolt pistol but operated by powerful spring. No explosives employed, therefore no noise or smell. Stunning is said to damage head, but damage not serious, if any.

### Pigs

Formerly animal stunned with blunt instrument then bled. Cash captive bolt pistol now often used. Electrical stunning tongs can be employed if electric current is available. Method provides thoracic bleeding as in bovines. After bleeding, carcases are immersed in hot water, scraped, and dressed. Where large numbers are slaughtered daily, electrical scraping machines employed. Stunning of swine has been objected to by butchers who state that complete bleeding is not achieved, and "splashing" may occur which interferes with bacon curing. Very little evidence to uphold these contentions.

### Dressing

OVERSTICKING means that knife has penetrated below throat into chest wall resulting in blood getting behind pleura. In such cases pleura removed.

BLOOD SPLASHING sometimes occurs, more often in pigs. Small blood spots throughout muscular tissue.

In dressing bovines, animal is rolled on back and hide incised from brisket to tail. Skin then removed from legs, feet and hocks detached at knees. Head severed from body by cutting at first cervical vertebræ. Hide removed as far down flanks as possible, abdominal cavity being opened and omentum or caul fat removed. Caul fat is later rolled, salted and when "set" sold as suet. Intestines and stomach

with spleen attached are next removed. Aitch bone then cut through and wooden tree passed through hind leg tendons and carcase hoisted to convenient height for completion of dressing. Bladder detached ; penis and testicles, or udder removed, followed by liver and pancreas, lungs, heart and trachea with œsophagus in that order. Hide then removed at neck and tail skinned and cut off. Vertebræ chopped or sawed down. Damp, hot clean cloths used to wipe down carcase. Two sides then transferred from tree to travelling hooks and hide entirely removed. Ragged pieces of fat, particularly on neck, trimmed away ; carcase set aside to cool. Later quartered.

Liver, heart, kidneys, spleen, throatbread and pancreas are set aside for sale. Stomach washed and sent to tripe boiler, lungs sold for cats' meat, intestines emptied of their contents, washed and sent to gut scraper. Hide, horns and hooves sent to fellmonger, and rough fats collected for soapmaker.

### Inflation of Carcases

Practice of inflating carcases of calves and sheep prior to dressing carried out to assist flaying and to improve appearance, increasing apparent value of meat. Removal of skin not assisted. Calf's head and lungs of calf or ox sometimes inflated. Inflation carried out by mechanical machine which has pointed nozzle. This is inserted through incision into subcutaneous tissue. Air distributed throughout carcase by means of stick. Objectionable in that air taken from floor level is not as clean as could be desired. Inflation by mouth or in manner likely to cause infection prohibited.

Inflated carcases recognised by unusual size and glistening appearance. Tissues spongy and crepitate (crackle). Not possible to determine method of inflation so should be prohibited on hygienic grounds.

### Dressing Calves and Sheep

Hide first removed entirely before carcase is opened. Internal organs removed, carcase hung on small wooden or metal tree. Lungs, heart and liver (pluck) removed together and not separated. Sometimes backstick placed through belly on one side, drawn round back and pushed through belly on opposite side so that carcase sets with interior visible. Carcase washed down after dressing.

### Dressing Pigs

Similar to calves and sheep ; head left attached and back sticking not generally employed.

## INSPECTION OF CARCASES

### Rigor Mortis

Stiffening which occurs in dead body due to coagulation of muscle plasma which during life is contractile, semi-liquid substance within muscle fibres. Coagulation results in formation of myosin, muscle clot which corresponds to fibrin in blood clot. In both cases, clotting produced by action of ferment developed after death. Gradual in onset, muscles becoming taut and acid in reaction; sarcolactic acid produced. Meat before setting is tough, but with acid formation, connective tissue becomes soft and gelatinous; muscle fibres loosen, meat becomes more tender and palatable. Rigor mortis usually persists from one to several days, beginning and ending being subject to considerable variation. Generally supervenes twelve hours after slaughter. Rigor passes off first in animals in which it appears first. Animals tired with muscular exertion often set within a few minutes. In exhaustive or febrile diseases, or with septic conditions, setting of muscles sometimes not observable.

### Appearance of Fresh Meat

Ox. Meat should be firm, elastic, moist though not wet, marbled appearance, fresh smell, should not pit. When unsound, softer than normal, wet looking, dark green or black, offensive odour, putrefaction near bone, straw-coloured fat.

Young cattle have light red meat, finely grained.

Bulls' flesh is dark red, tough, coarse-grained, poor in fat. Often smells offensive.

Calf. Light, pale red in colour. Fat, reddish white, whitening with age. Fine fibre.

Horse. Dark red colour, coarse texture, odour unpleasant, yellowish fat, oily, sickly smell, flesh never sets.

Sheep. Light red or brick colour, fine fibre, moderately firm in consistency. White, hard fat, rather suety.

Goat. Flesh darker than mutton. Fat less abundant on body though equally as much on loins. Goaty odour. Fat similar to that of mutton.

Pig. Pale red or rose colour, in part white, fine fibre, medium consistency, odour indefinite. Fat white and oily.

### Appearance of Imported Meat

Chilled—kept at temperature of 28·5°–30° F. Frozen—kept at temperature under 18° F.

Principal defects are moulds, brine stains and abnormal odours. Variations in temperature cause moulds—fluffy

white patches in early stages ; later black spots. Sometimes carcases quickly decompose. In inspection, judgment based on 10 per cent. of whole.

IMPORTED MEAT after exposure to atmosphere for short period appears limp and exudes moisture. Fat very white turning yellow when thawed ; flesh bright red colour owing to hæmoglobin dissolved in fluids and permeating tissues. Cut surface has moist feel. Fat often stained by meat juices. Frozen offals may take some discolouration from containers but be quite sound—discolouration usually disappears when thawed out. Liver may show small fatty crystals on surfaces.

IMPORTED MUTTON OR LAMB—fat ragged and greyish in colour, dirty rough appearance ; muscle pale, fat very white.

IMPORTED PORK—skin darker, muscle paler, fat harder.

### Examination of Carcases

Following points to be noted :

(1) Blood should be examined and skin also when removed from carcase.

(2) Appearance of animal, emaciated, well-fed, discoloured. Outside fat should be light yellow, free from hæmorrhagic patches.

(3) Carcase should set well (8 to 12 hours).

(4) Pleura and peritoneum examined for evidence of stripping and tubercular deposits ; also posterior surface of diaphragm.

(5) Bones and joints examined.

(6) Lymphatic glands incised where necessary.

(7) Head, tongue and glands of same.

(8) Lungs, heart, trachea and œsophagus, liver, spleen, stomach and intestines, bladder, udder (if any) and glands of same. Incisions should be made where necessary.

Memo. 62 (Foods) should be carefully studied and memorised.

## ANATOMY AND PHYSIOLOGY

### Animal Body

Consists of :

(1) TISSUES. Made up of cells.

(*a*) *Epithelials.* Outer layer of skin—covering mucous membrane—intestinal cavities and joints—heart, lungs, blood vessels and glands.

(*b*) *Connective.* Holds organs in position—surrounds and penetrates muscles—covers nerves and blood vessels.

(*c*) *Muscular.* Red flesh—made up of fibres.

(*d*) *Nervous Tissue.* Made up of nerve cells, nerve fibres and supporting tissue.

(2) Skin. Outer layer, epidermis. Deep layer, true skin. Forms protective covering of body ; acts as secretory organ and regulates body temperature.

(3) Membranes. *Serous*, lines body cavity, pleura and peritoneum.

*Synovial*, lines joints.

*Mucous*, lips, mouth and nostrils, alimentary tract, genitals, urinary tracts.

(4) Cartilage. Gristle ; tough flexble tissue.

(5) Bone: Hard tissue forming skeleton of animal.

(6) Joints. Assist motions of legs, shoulders and quarters —movable (legs, tail, shoulders) or immovable (pelvis, skull).

## Bones

Bone is hard, compact material enclosing cavity filled with marrow. In new or unborn animals, marrow is red in colour. In older animals, is red in flat bones and white or yellow in long bones ; fatty in consistency. In healthy bones, marrow does not flow. Bones forming movable joints generally expanded at ends and covered with cartilage giving pure white polished appearance. Held together by bands or capsules of fibrous tissue termed ligaments and lubricated by serous fluid.

Ribs joined to vertebræ by cartilage. Attached to each dorsal vertebræ is pair of ribs. Forward ribs joined to sternum. At lowest end of each rib is piece of gristle or costal cartilage. Remaining ribs attached indirectly. Vertebræ hollow. Spinal cord carried in spinal canal,

Table 2

*Bones of Various Food Animals*

| | Ox. | Sheep. | Pig. | Horse. |
|---|---|---|---|---|
| Cervical . . | 7 | 7 | 7 | 7 |
| Dorsal . . | 13 | 13 | 14 | 18 |
| Lumbar . . | 6 | 6 | 6 | 6 |
| Sacral . . | 5 | 5 | 4 | 5 |
| Coccygeal . . | 15–20 | 15–20 | 20–23 | 18–20 |
| Ribs. . . | 13 | 13 | 14 | 18 |
| Teeth . . | 32 | 32 | 44 | 36 & 40 |

Sacrum solid unyielding bone forming roof of pelvic cavity. Chestbone flat. Bones of hind leg—tibia and fibula, foreleg—ulna and radius ; shoulder is scapula ; hip, ilium. Pelvic bone composed of ileum, ischium and pubic bone. Knee-cap or patella relatively same as in human being. Table 2 below gives differentiation of bones of various food animals.

### Mouth

Part of head containing tongue—bony structure, firm and resistant to touch—roof of mouth, hard palate ; fleshy, more yielding part, soft palate.

### Tongue

Muscular organ covered with thick, dull mucous membrane.

OX. Thicker and firmer than horse, has dorsal swelling, pointed at tip ; upper surface, especially at base, rough and bristly, due to spine-like filiform papillæ covered with horny sheaths and directed in backward direction. Possesses six or more circumvallate papillæ on either side. Epiglottis rounded. Black spots frequently found on ox tongues (natural). The *os hyoides, i.e.* bone at base of tongue which gives support has nine segments.

HORSE. Longer, narrower, less firm than ox, broader at tip, surface not so rough, filiform papillæ found more at sides and tip, not so much at base. Only two circumvallate papillæ, one each side. Spatulate in shape. Epiglottis pointed. Black spots never found. *Os hyoides*, five segments.

SHEEP. Thick, short, tip round, notched in middle line. Nine to twelve circumvallate papillæ each side. Filiform papillæ short but not horny. Tongues of black sheep may exhibit black patches.

GOAT. Like sheep, end hollowed out. Twelve circumvallate papillæ each side.

PIG. Smooth, no dorsal swelling. Two circumvallate papillæ, one either side of middle line. Slightly pointed at tip, filiform papillæ slender and uniformly introduced over anterior two-thirds of tongue. Base of tongue covered with numerous pointed papillæ. Epiglottis round.

### Pharynx and Œsophagus

Tubelike structures extending from mouth to stomach. Pharynx is part between mouth and œsophagus. Œsophagus is second part from pharnyx to stomach.

### Thorax and Abdomen

Interior of animal divided into two parts by muscular

structure called *diaphragm.* First compartment, *thorax* contains trachea, œsophagus, lungs, heart. Second is *abdomen,* contains stomachs, liver, spleen, intestines and kidneys. Inner surface of walls and abdomen covered with smooth, glistening serous membrane termed peritoneum. Special folds of this enable stomach and intestines to be held in position, attaching them to abdominal walls.

### Stomach

Ox. Sac-like structure. Walls consist of three layers—peritoneal covering externally—strong muscular coat in centre—thick mucous membrane lining interior. White or blue-grey external appearance and smooth shining surface, due to peritoneal covering. Occupies greater part of abdominal cavity. Four divisions, viz. :

(1) *Rumen.* Situated left side of body ; occupies three-quarters of abdominal cavity ; recticulum lies in front and abomasum to right. Spleen attached to left side. Interior lined with small pinnicle projections. Large—two lobes.

(2) *Reticulum.* Smallest of four ; interior possesses honey-comb appearance.

(3) *Omasum.* Membrane arranged in longitudinal folds ; oval in shape ; difficult to clean for tripe.

(4) *Abomasum.* Next in size to rumen ; pear-shaped ; reddish colour ; soft and velvety to touch. Interior lined with muscle-like projections resembling blisters from which fluid has escaped.

FUNCTIONS. Function of first three compartments is mainly trituration and maceration ; digestion proper takes place in abomasum. In ruminants, fermentation occurs in stomach ; in other animals, in intestines. When feeding, herbage is barely masticated and passes into paunch where it accumulates and undergoes trituration. When paunch is full, animal ceases to feed and food is regurgitated into mouth for more thorough chewing. Then passes into reticulum and is there formed into smooth lubricated wad. This is expelled into œsophagus, seized by spiral muscles of throat and forced into mouth, again chewed, swallowed, and enters omasum, where it spreads over surface of laminated walls and is prepared for last or true stomach.

HORSE. Single compartment ; in form of curved sac, constricted in middle.

SHEEP AND GOAT. Four compartment stomach similar to ox.

PIG. Single compartment stomach ; kidney shaped ; distinguished by small cul-de-sac present at upper and left side of cardiac.

**Mesentery**

Fatty matter to which intestines are attached.

**Omentum**

Or caul fat. Fatty matter surrounding part of stomach and intestines.

**Offal**

Head, hide, feet and all internal parts of animal except kidneys ; in case of pigs, only internal parts, less kidneys, known as offal.

**Ductless Glands**

Thymus or thyroid glands, situated one on lower side of trachea, other on pericardium; known as sweetbreads. Others are suprarenals (kidneys), pituitary (brain), pineal (brain) and spleen. (See page 18).

**Pancreas**

Whitish conglomerate gland of irregular shape situated beneath stomach ; pours its secretion into alimentary canal during digestion. Most important digestive organ.

**Pluck**

Calves', sheep's or pig's pluck consists of lungs, heart, liver, trachea and œsophagus.

**Intestines**

Tubelike structure commencing at pylorus of stomach (valve-like structure which prevents regurgitation of contents of intestines into stomach) and ends at anus. External surfaces of blue-grey colour, smooth and glistening. *Small intestines* commence at pylorus and end at ileo-cæcal valve, where it joins large intestine. Composed of duodenum, jejunum and ileum. *Large intestine* composed of cæcum, colon and rectum. Ileo-cæcal valve prevents ebb from large to small intestine. Cæcum is broadest part of intestinal tract, walls being thicker and more muscular than small intestine.

LENGTHS.

| | Small. | Large. |
|---|---|---|
| Ox . . . | 140 ft. | 36 ft. |
| Sheep . . . | 80 ft. | 20 ft. |
| Pig . . . . | 56 ft. | 16 ft. |
| Horse . . . | 70 ft. | 28 ft. |

**Spleen**

Ox. Sometimes called melt. Reddish-brown to dark red, borders rounded ; soft but elastic in consistency. Elongated, oval-shaped, about 3 lb. in weight. In bulls and steers, red-brown, thick, firm, surfaces convex, follicles size of hemp seed. Cows—grey-blue, flabby with flat surfaces, sharp borders. When incised, interior is reddish-brown matrix through which very small follicles are scattered.

Horse. Bluish-violet when first removed, turning to reddish-brown ; sickle shaped ; weight 2 lb.

Sheep. Oyster-shaped and blunt ; reddish-brown ; 3 oz. in weight.

Pig. Long, narrow, tongue-shaped. Ridge of fat on one side. Bright red ; 4 to 6 oz. in weight. Prominent follicles.

**Liver**

Ox. Reddish-brown organ situated between diaphragm, to which it is attached by bands of peritoneum, and stomach. Borders sharp, firm and elastic in consistency. Two lobes and thumb-piece ; gall-bladder. Cystic and hepatic ducts which convey bile to intestines join before entering duodenum. Hepatic gland situated round point where they leave and portal vein enters liver. 12 to 14 lb. in weight. In calves and young animals of from one to four years of age, organ is thick, surfaces convex, borders slightly rounded. In older cattle, liver thinner, surfaces more even, borders sharp, flabby consistency.

Horse. Much similar ; four lobes ; no gall bladder or thumbpiece. Weight 11 to 14 lb.

Sheep. Similar to ox liver except smaller ; weight 1 to 2 lb. Lambs' livers not so light in colour as calves' but lighter than sheep or ox livers.

Pig. Four main lobes together with smaller one or thumb-piece and gall bladder. Slightly darker than others. Weight 1½ to 2 lb. Surface markedly lobulated.

**Urinary System**

Consists of *kidneys* (excretory organs) which separate urine from blood ; *ureters* which carry fluids to bladder, and *urethra* which convey liquid from bladder to exterior. Kidneys situated one either side of vertebral column in region of upper loin. Reddish-brown and firm generally ; each has capsule, thin membranous covering, readily stripped from healthy organ. In section, composed of two parts, external or cortical portion and internal or medullary portion. *Cortex* granular in appearance with numerous red spots scattered through substance. *Medulla* made up of dark-coloured,

pyramidical-shaped masses whose bases rest on cortical portion and apices converge towards centre of organ ; masses composed of large numbers of minute tubules which separate urine from blood. Urine collects in central portion of organ and is conveyed by ureter to bladder. *Bladder* is roundish membranous sac.

## Kidneys

Ox. Oval ; reddish-brown ; deeply lobulated, 15 to 29 lobules. Right attached to abdominal walls, left floating, *i.e.*, attached one end only, appears partly twisted. Weight, 1 to 1½ lb. each.

Horse. Smooth ; non-lobulated ; reddish-brown. Left, bean-shaped ; right, heart-shaped. Weight about 2 lb. each.

Sheep and Goat. Smooth, non-lobulated, bean shaped. Dark red. Rounder than pig's kidney. Weight about 2 oz. each.

Pig. Smooth, non-lobular, bean-shaped. Pale red. Weight, ¼ to ½ lb. each.

## Generative Organs

Male. Testicles, penis, sheath and necessary glands.

Female. Ovaries, fallopian tube which carry ova to uterus, vagina, external orifice.

Udder is mammary gland of cow ; four quarters, each possessing teat with mild duct which connects to smaller ducts and finally to gland cells. Each quarter entirely separate.

## Larynx

Situated between two halves of lower jaw ; forms commencement of trachea.

## Trachea

Tube made up of large number of cartilaginous rings, bound together by muscular tissue. Commences at larynx, and continues to thoracic cavity ; divides into small branches (bronchi), one for each lung. Bronchi are divided and subdivided in each lung or pulmonary tissue.

## Lungs

Soft and elastic organs. When well-bled, rose-red in colour ; smooth glistening surface. Section of healthy lung will float. On incision, frothy fluid of light reddish colour exudes from cut surface. Surface of organ covered with smooth, semi-transparent serous membrane called *pleura*. After covering each lung, the two layers come off in middle

line and ascend in upward direction, becoming attached to vertebral column. Space in thorax between the two layers is termed *mediastinum*. After ascending vertebral column, two layers diverge and sweep downwards and outwards clothing internal surface of thoracic walls. This is *parietal layer*; lung covering termed *visceral layer*. With œsophagus in front and trachea at back, right and left lungs are denoted.

Ox. Made up of lobules each about size of shilling. Bright red; firm; left side three and right side four or five lobes.

Sheep and Goat. Smooth and bright on surface; interlobed; lobes similar to ox; interior dense and leathery, not so bright in colour.

*Note*. Ox, sheep and goat receive independent bronchus from lower part of trachea, thus differing from horse.

Horse. Smooth in structure; left, two; right, three lobes. Lobules not well defined.

Pig. Interlobed and soft. Left, two or three lobes; right, three or four. Easily broken down.

## Heart

Lies within closed membranous sac termed *pericardium*. Divided into two compartments by wall. Each side has two chambers, upper one termed *auricle*; lower, *ventricle*. Valve allows blood to flow from $A$ to $V$, but not in reverse direction.

Ox. Conical in shape, well-fatted about base and has three well-marked furrows running from base to apex. Firm, white fat. Contains bone, *os cordis*, situated in aorta.

Horse. Blunter than bovine heart; scanty fat; two furrows and no *os cordis*. Cardiac cartilage may become ossified in older animals.

Sheep and Goat. Same shape as ox; firm, white fat; no *os cordis*. In older animals, small bone may develop on right side.

Pig. Blunter, with soft and less fat than in sheep. Similar to horse. In older animals, cardiac cartilage may become partly ossified.

Table 3

*Weights of Various Organs*

| | Heart. | Spleen. | Liver. | Kidney. | Lungs. |
|---|---|---|---|---|---|
| Ox . . | 4–6 lb. | 3 lb. | 12–14 lb. | 1–1½ lb. | 7½–8 lb. |
| Horse . | 6–10 lb. | 2 lb. | 11–14 lb. | 2 lb. | 7½–8 lb. |
| Sheep . | ½ lb. | 4–6 oz. | 1–2 lb. | 2–4 oz. | 1½ lb. |
| Pig . . | 1 lb. | 3 oz. | 1¼–2 lb. | 4–8 oz. | 1½–2 lb. |

**Pulmonary System**

Veins bring blood to heart ; arteries carry it away. Blood passes from right auricle to right ventricle, contraction of which forces it into *pulmonary artery* which divides into two branches, thence to lungs. After passing through lungs, blood is conveyed by *pulmonary vein* into left auricle.

**Systemic Circulation**

Blood passes from left auricle into left ventricle ; is driven by contraction into systemic artery, termed *aorta*, which, in turn, branches off into *arteries*. These convey blood to all parts of body, eventually becoming *capillaries*. In its passage, blood gives up oxygen and nutritive materials to tissues and receives waste products ; becomes changed from pure arterial blood (scarlet) to impure or venous blood (dark bluish). Capillaries then unite to form veins which gradually increase in size ; those from head, neck and shoulders forming into *anterior vena cava* ; those from hinder quarters form into *posterior vena cava*. These convey blood back to right auricle from where it passes through valve to right ventricle.

**Portal Circulation**

Blood from stomach, intestines and other abdominal organs gathered into single stream ; conveyed by portal vein to liver, through which organ it passes before reaching heart .

**Lymphatic System.**

Thin-walled tubes originating with open ends in tissue in lymphatic spaces. System in close relationship with circulation of blood. Fluid portion of blood constantly transudes through thin walls of capillaries carrying oxygen and nourishment to tissues. Exuded *blood plasma* or *lymph* not absorbed by tissues collects in lymphatic spaces from whence it is conveyed by *lymphatic capillaries* to glands. After traversing one or more of these, lymph is conveyed by other lymphatics which join together to form two large trunks—*thoracic duct* which discharges into *left axillary vein* on one side and *lymphatic trunk* which discharges into *right axillary vein* on other, being thus returned to blood stream again. No lymph can enter duct or trunk without passing through at least one gland.

**Glands**

Solid tubes of semi-solid tissue, varying in colour from whitey-grey to greyish-blue. In pigs, generally creamy. Size varies from pea to walnut ; may be oval, spindle-shaped

or round; undergo marked changes in size, substance and colour if diseased. Relatively larger in young animals than in older ones. Usually firm in consistency, those of abdominal cavity being softer than those of trunk and extremities. When sectioned, moderate quantity of fluid exuded. Lymph from each region of body drains into certain glands; diseased glands therefore indicate certain diseased areas.

### Glands of Ox and Sheep

SUBMAXILLARY. On inner side of lower jaw, near its angle. Close to salivary gland. Usually removed with tongue but portions found at above point. *Drains* lower half of head. *Incise* at angle of lower jaw.

RETRO-PHARYNGEAL. Lie on each side and posterior to pharynx and on underside of hyoid bone near its attachment to skull. If head be placed face downwards on table with base towards inspector, may be reached by raising cut end of trachea with left hand, feeling for hyoid bone; *lateral incision* at this point reveals glands. Generally exposed on removal of tongue. *Drain* lymph from throat, base of skull and cranial cavities.

PAROTID. Just below root of ear and held against edge of lower jaw bone. Almost surrounded by salivary glands of same name. *Drain* ear and base of skull. *Incise* through salivary gland.

CERVICALS. *Upper* (*cranial*) lie along each side of larynx near trachea. *Middle* lie alongside trachea. *Incise* along jugular furrow. *Drain* base of skull, cranial cavity, larynx, pharyngeal muscles, œsophagus and trachea. *Lower* situated at point where windpipe enters chest cavity, anterior to first rib. *Drain* lymph vessels of head, neck and shoulder. *Incise* along neck. (See other Cervicals).

INTERCOSTAL. Also known as Dorsal-costal. Glands of superior thoracic wall. In intercostal spaces, close to vertebræ, embedded in fat and muscle. Size of pea; sometimes removed in dressing. *Drain* muscles of back and diaphragm. *Incise* fatty tissue of intercostal spaces.

AXILLARY. Brachial. Cluster of glands covered by scapula, behind second rib. Scapula must be removed before visible. *Drain* from anterior thoracic wall and scapula. *Incise* on outer side of second rib.

SUPRA-STERNAL. Sternal-costal. Between costal cartilages of first six ribs near junction with sternum. Exposed by *incision* a little above and parallel with sternum. *Drain* anterior surface of diaphragm and intercostal muscles.

SUPERFICIAL INGUINAL. In male. Situated in scrotum or cod fat, close beside penis. *Drain* from external genitals,

interior abdominal wall and median femoral region. *Incise* at base of cod fat.

SUPRAMAMMARY. In female. Lie above and behind udder. *Drain* similar sites as superficial inguinal. *Incise* behind udder.

DEEP INGUINAL. Normally small. Inlet of pelvis in femoral canal. *Drain* lymph from popliteal glands, penis and thigh. *Incise* at edge of loin suet.

ILEACS. Internal and external, at top of kidney fat, close to arteries of same name, about 2½ inches lower than deep inguinal. *Drain* kidneys, genitals, hip and femur. *Incise* along ileac arteries.

SUB-LUMBAR. Beneath lumbar vertebræ. *Drain* abdominal walls, lumbar muscles and organs in pelvic cavity. *Incise* fat along abdominal aorta on either side, in suet.

POPLITEAL. In thigh muscles, immediately above and behind stifle joint. *Incised* when tissue is cut down to joint. *Drain* external surface of hindquarters.

PRECRURAL. Large size; in fascia of groin. *Drain* anterior muscles of thigh and outer abdominal wall. *Incise* longitudinally on outside of carcase along centre of groin fascia.

PRESCAPULAR. Between neck and shoulder, embedded in fat in front of shoulder joint. Measure four fingers from point of shoulder to neck and make *incision*. *Drain* neck, shoulder, arm and forearm.

SACRAL. Embedded in fat in region of sacral vertebræ. *Drain* pelvic region and rectum. *Incise* near lateral border of sacrum.

BRONCHIAL. Lie in lung substance at both sides of trachea near point of bifurcation into two bronchii. Those on left side covered by arch of aorta. *Incise* from above alongside trachea to point of bifurcation. *Drain* from lungs and posterior mediastinal glands.

MEDIASTINAL. Situated in fatty tissue between lungs. Anterior, middle and posterior, latter elongated. *Drain* ribs, pleura, diaphragm, peritoneum and lungs. *Incise* in fat between lungs.

HEPATIC (LIVER). Portal. Embedded in fat in portal fissure of liver. *Drain* liver and pancreas. *Incise* fat.

RENAL (KIDNEY). Situated at hilus of kidney opposite second lumbar vertebræ. *Drain* kidneys. *Incise* fat at this point.

SPLENIC. In the hilus of spleen and ligament which attaches spleen to stomach. When organ removed usually attached to stomach. *Drain* spleen. *Incise* ligament if in position.

MESENTERIC. Situated in mesentery or intestinal fat. *Drain* intestines. *Incise* each gland as palpated.

## Important Glands of Pig

SUBMAXILLARY. Covered by salivary gland of same name. *Incise* horizontally behind or through this gland.

PAROTID. Chain of glands along posterior of lower jaw. *Incise* at this point.

CERVICALS. Incise vertically a little above and to outer side of submaxillary salivary gland.

RETRO-PHARYNGEAL. Smaller than in cattle and set further back. *Incision* made at similar point.

PRESCAPULAR. In shoulder. *Incision* made from inside.

SUPRA-STERNAL. One large gland in articulation of 1st and 2nd segments of sternum. Seen when animal split open. *Incise* between 1st and 2nd segments.

INTERNAL ILIAC. *Incise* at top of kidney fat.

SUPRAMAMMARY. In female. Incise above and behind udder.

PRECRURAL. In fascia of groin. Can be *incised* from inside carcase.

POPLITEAL. In fleshy part of thigh. *Incise* 3 or 4 inches above hock.

Other important glands are bronchial and mediastinal, hepatic and mesenteric—positions much similar to those of ox.

## Age

YOUNG. Cartilages covering articular surfaces blue and rosy. Become white with increasing age. Up to three years possible to cut through ischio-pubic symphysis with knife. After three years junctional cartilage becomes osseous. Up to three or four years, costal cartilage at ninth rib can be cut through with comparative ease. At five, difficult; at six, impossible.

INTERVERTEBRAL DISCS become thinner with age. Bones soft, smaller and more vascular than older animal. Inner surface of ribs pink. More gristle on cartilages and joints

OLD. Bones large, hard, dense, less vascular. Inner surface of ribs white. Less gristle, none at ischio. Horns get one ring at three years, then one every year.

## Teeth

ADULT OX. Has eight incisors in front of lower jaw. Front part of upper jaw devoid of teeth, provided with dense fibrous pad. At back of both jaws are molar teeth, twelve in each jaw, used for grinding when ruminating. Under one

year, bovines still have milk teeth, eight in number. These persist until 1½ years. Replaced by permanent teeth as follows :

Central teeth up at 1½–2 years.
Middle teeth up at 2½–3 years.
Lateral teeth up at 3½–4 years.
Corner teeth up at 4½–5 years.

After five years teeth wear down and become ringed ; after ten years, much worn, project from gums and are widely spaced. *Total number :* 32.

HORSE. Twelve incisors, six lower and six upper, in addition to which male has four canine teeth. *Total number :* 36 and 40.

SHEEP. Eight incisors in lower jaw.

Central are up at 1 year.
Middle are up at 1½ years.
Lateral are up at 2¼ years.
Corner teeth up at 3 years.

*Total number :* 32.

PIG. Six incisors and two tusks.
Lateral are up at 9 months.
Central are up at 1 year.
Corner teeth up at 1½ years.

*Total number :* 44.

## Distinguish Features of Sex

BULL. Retractor and erector penis muscles well developed ; cod fat ; muscles of neck and shoulders well developed ; flesh coarser and darker in colour than ox and contains less fat ; gracilis muscle triangular ; anterior part of ischio well developed and forming distinct tubercle. Well developed muscle where neck joins back ; penis or furrow.

OX. Scrotal fatty tissue or " cod fat " very abundant ; also fatty tissue surrounding kidneys ; aitchbone slighter ; anterior pubic tubercle is smaller ; erector muscle less broad ; muscles of shoulder and neck not so well developed.

COW. Thin buttocks and flanks ; thin neck ; line of vertebræ concave at neck and loin ; flat chestbone ; pelvic bone poorly developed ; pelvic cavity large ; udder usually removed and flesh skewered back ; angles of haunch prominent ; floor of pelvis less curved.

HEIFER. Carcase nicely rounded ; bones and muscles small ; ribs pinky ; quantity of fat in place of udder ; fat in pelvic cavity ; mammary glands poorly developed and whiter than cow.

RAM. Thick scrag ; prominent crest ; broad and massive shoulders ; thin hindquarters ; little cod fat ; penis usually removed ; large forearm ; flesh dark and coarse ; inguinal canal always present (hole or sinus where spermatic cord leading to testicles comes through) ; root of penis sometimes cut back as far as possible and root greased or smeared over with fat.

WETHER. Castrated male ; hindquarters more plump than ram ; cod and other fats plentiful.

EWE. Neck long and slender ; back flat, fat evenly distributed about body ; udder in place of cod fat ; knuckle joints bleached ; udder sometimes trimmed away.

GIMMER. Hindquarters plump ; neck slender ; no udder fat ; fat firm and plentiful ; flesh of reddish colour ; ribs pinky ; knuckles blue.

BOAR. Strong smell ; certain lean appearance about hindquarters ; pronounced muscular development about shoulders due to cartilaginous plate known as shield.

SOW. Recognised by well-developed nipples ; large size ; strong muscular development ; small amount of fat internally.

PIG. If male, usually castrated as it fattens better, known as hog ; female known as gelt or spaid ; meat pinky or light red ; carcase rounded ; well fattened on back and flanks.

## Differentiation of Various Animals

OX. Dorsal, lumbar and sacral vertebræ larger and stronger than horse. Spinous processes of lumbar vertebræ perpendicular ; some distance apart. Ribs of ox are longer, straighter and broader than those of horse.

HORSE. Ribs more rounded than bovines ; of fixed union with vertebræ. Bones larger and contain oily substance instead of marrow. Neck of scapula is thick but spine of scapula has not groove present in bovine scapula. Ulna bone smaller ; radius longer and more curved ; sternum, keel shaped ; sacrum, more arched ; pelvis shorter and broader. Spinous processes directed forward and in close contact with each other. Old dried bones do not bleach but remain dark.

GOAT. Absence of fat on back ; flesh dark and coarse ; has goaty odour. Neck and shanks are longer and thinner than sheep ; shoulders small ; "plates" of belly dark. Plenty of kidney fat ; transverse lumbar processes curved downwards.

BOVINES. Bull implies entire male over 1 year old.

Bullock or ox implies castrated male animal.

Bull calf implies male up to one year old.

Cow implies female after having a calf.

Heifer or stirk implies female over one year old before calving.

Heifer calf implies female up to one year old.

SHEEP. Ram or tup implies entire male after second *shearing*.

Wether implies castrated male.

Shearling tup or wether implies castrated or uncastrated males between first and second shearing.

Tup hog or wether hog implies male up to one year.

Tup lamb is lamb under three months.

Ewe implies female after having had one lamb (over one and a half years).

Gimmer implies female between first and second shearing (over one year).

Ewe hog—female under one year.

Ewe lamb—female under three months.

PIGS. Boar implies entire male.

Hog implies castrated male.

Sow implies female after having young.

Gelt implies female before having young.

Cut sow implies female with womb removed when young.

Porkers or suckers—young or newly-born pigs of either sex.

## DISEASES OF FOOD ANIMALS

### GLOSSARY OF IMPORTANT TERMS

ABSCESS. Cavity containing pus.

AMYLOID DEGENERATION. Waxy growth on liver.

ANTHRACOSIS. Blackening of lungs (Melanosis).

ASCITES. Dropsy of peritoneum.

ATELECTASIS. Collapse of air cells in lungs.

ATROPHY. Wasting.

BRUISE. Collection of blood beneath skin. Does not pit on pressure.

CALCIFICATION. Breaking down of cells forming lime-like deposit.

CASEATION. Breaking down of cells forming cheesy-like material.

CLOUDY SWELLING. Change in cells only seen under microscope.

CONGESTION. Super-abundance of blood.

CATARRH. Inflammation of mucous membrane.

CIRRHOSIS. Presence of an abnormal amount of fibrous tissue.

CORTEX. Surface layer of an organ.

CYST. Bladder or sac-like formation of a pathological nature.

CYSTITIS. Inflammation of bladder.

DEGENERATION. Cell albumen is converted into some other substance such as fat.

ECCHYMOSIS. Appearance of livid spots on skin occasioned by effusion of extravasated blood.

ECTASIA. Dilation or distension.

ERYSIPELAS. Inflammation of skin and subcutaneous tissues.

ENDOCARDITIS. Inflammation of heart.

EMACIATION. Absence of fat on carcase due to invasion by organisms of disease.

EMPHYSEMA. Gas.

FATTY DEGENERATION. Change which is visible to naked eye. Cell albumen is changed into oil. Softer and smaller.

FATTY INFILTRATION. Deposit of fat in form of globules. Affects liver, heart and kidneys. Liver retains its functions but is often enlarged.

GLAND. Secreting organ.

HEPATISED. Liver-like.

MALFORMATIONS. Changes in formation of organs, *e.g.*, extra lobes in liver, fissures in kidneys.

HYPERTROPHY. Part abnormally enlarged.

MALIGNANT. Virulent—dangerous.

METABOLISM. Chemical change in living tissues.

MYOCARDIUM. Muscular tissue of heart.

NECROSIS. Local death of tissue.

*ŒDEMA. Water or dropsy.*

PAPULES. Elevated skin lesions, any shape or colour.

PETECHIAL SPOTS. Small blood spots.

PUSTULES. Elevation of skin containing pus.

PLEURISY. Inflammation of pleura.

PNEUMONIA. Inflammation of lungs.

POORNESS. Physiological condition—wanting in fat or due to feeding.

PUS. Albuminous fluid containing dead leucocytes.

PUTREFACTION. Breaking down of an organic substance due to micro-organisms.

PYÆMIA. Pus in blood—affected organ may show few abscesses.

SAPRÆMIA. Blood containing toxins or poisons.

SEPTICÆMIA. Condition due to infection by pyogenic organisms. Main seat of infection in blood.

SLINK CALF. Calf taken from uterus.

STREPTOCOCCI. Pus-producing organisms.

SUPPURATION. Condition produced by growth of pyogenic or pus-producing organisms in tissues of living animal.

TRITURATE. Grind to fine powder.

ULCER. Sore attended by discharge.
UMBILICUS. The navel.
URÆMIA. Retention in blood of kidney secretions.
VESICLE. Small blister containing serous fluid.

## PHYSIOLOGICAL CONDITIONS

### Abnormal Colouring of Fat

Fat may have yellow colouration due to pigmentation and originating from chlorophyll in grass. Differentiated from jaundice in that colouration limited to fatty tissue. Channel Islands cattle normally possess yellow fat.

JUDGMENT. If meat is normal, carcase may be passed.

### Abnormal Odour and Taste

Several causes, viz.:

(*a*) Feeding stuffs—fish, turnips.

(*b*) Sexual odour—principally in meat from uncastrated male animals.

(*c*) Drugs—due to ingestion of drugs during illness.

(*d*) Absorption—meat will absorb offensive smells such as ammonia tainting in cold store.

Smell most pronounced when carcase is warm; may be almost imperceptible when cold. Roasting and boiling tests of portions suspected are necessary.

JUDGMENT. If very marked and maintained, carcase is condemned. If odour disappears twenty-four hours after slaughter, carcase may be passed.

### Badly Bled

May be due to weakness of heart or failure to empty blood vessels of their contents. Flesh dark, carcase sets badly, organs congested. Flesh rapidly decomposes.

JUDGMENT. Carcase condemned.

### Emaciation

Care must be taken to distinguish from leanness; is pathological condition; nutrition below normal; organs may be smaller, muscles sunken and flaccid; fatty tissue becomes gelatinous.

JUDGMENT. If due to disease, carcase condemned. If severe, condemn. Otherwise judge on merits.

### Immaturity

Immature young of all food animals sometimes killed, dressed and exposed for sale. Calves should be at least

fourteen days old before slaughter; lambs and pigs should be three weeks old before sold. Immaturity denoted by:

(*a*) Muscles flabby, greyish-red, poorly developed.

(*b*) Bone marrow soft and dark red.

(*c*) Kidneys badly developed; deep violet-red or greenish colour; surrounded by greyish fatty tissue.

(*d*) Umbilical cord not mummified.

JUDGMENT. Condemn carcase.

**Poorness**

Chiefly due to malnutrition; or failure of digestive processes. Absence of fatty tissue; dark red musculature; not to be confused with emaciation.

JUDGMENT. Carcase passed if otherwise sound.

**Stillborn**

Unborn and stillborn animals sometimes dressed and exposed. Detected as follows:

(*a*) Eyes closed.

(*b*) Lungs sink in water.

(*c*) Muscles flabby and sodden.

(*d*) Gelatinous connective tissue around kidneys.

(*e*) Red marrow in long bones.

(*f*) Teeth covered by gums.

JUDGMENT. Carcase condemned.

## INFLAMMATORY DISEASES

**General**

Inflammatory diseases always accompanied by elevation of temperature; carcase may therefore have to be condemned on account of fevered condition of flesh (see page 27). In chronic cases, only affected part destroyed if flesh is otherwise sound. If septic, flesh usually dark, flaccid, soapy to touch and putrifies rapidly. Fevered flesh and organs usually darker in colour than normal and show small hæmorrhages in substance.

**Endocarditis**

Inflammation of internal lining of heart, mostly in pigs. Often caused by swine erysipelas. Nodular vegetation found on valves of heart; sometimes only lesions present.

JUDGMENT. Condemn affected organ (see Swine Erysipelas).

**Enteritis**

Inflammation of intestines; generally result of other diseases; inflammation, swelling, redness, hæmorrhagic;

mesenteric glands swollen. Found in calves as "bloody enteritis," disease often being fatal.

JUDGMENT. If disease is slight, intestines and mesentery condemned. If flesh of carcase is fevered, dropsical or emaciated, carcase and organs condemned.

### Fever

Produces marked changes in carcase ; cause attributed to bacterial poisons changing food substances into energy, heat (metabolism) ; organs show cloudy swellings. Flesh dark ; small hæmorrhages scattered through substance ; glands enlarged and softened ; small vessels full of blood ; flesh soapy to touch (albuminous) ; redness of peritoneum.

JUDGMENT. Carcase judged when hung for twelve hours as to setting ; general condition taken into consideration, also degree of fever reached and origin. In acute cases, carcase and organs condemned.

### Glossitis

Inflammation of tongue ; due to mechanical injury or insect sting ; if acute, tongue swollen and red or dark reddish-brown ; saliva discharged ; tongue protrudes from mouth.

JUDGMENT. Organ condemned.

### Hepatitis

Inflammation of liver due to action of toxins or bacteria ; organ enlarged ; fatty degeneration ensues ; abscesses, often multiple, may form.

Cirrhosis of liver is form of hepatitis ; increase in connective tissue in organ ; first enlarged, later small, hard and irregular in shape. In pigs, liver may be twice normal size.

JUDGMENT. Organ condemned. Carcase passed if no other disease or inflammatory conditions present.

### Mammitis

Inflammation of udder ; may attack any female animal during lactation. Two types, viz. :

(*a*) *Simple.* Garget ; may affect one or more quarters of udder ; animal fevered, restless and appetite affected ; affected quarters red, swollen, painful to touch ; watery fluid, pus or blood can be pressed from teat.

(2) *Suppurative.* Abscesses may form, containing greenish pus ; high fever may accompany condition.

JUDGMENT. If simple form, udder and lymphatics condemned. With fever and acute suppurative conditions, carcase and organs condemned. A fœtid form of this disease with malodorous flesh is a cause of food poisoning.

## Milk Fever

Attacks cows immediately before or after partutition. Caused by rush of blood to udder causing anæmia of brain; animal becomes comatose and unable to rise; if animal has been down a day or two before slaughter, tissues of side laid upon will be dropsical and vessels sometimes filled with blood; flesh in all cases very dark and sticky to touch; blood vessels engorged, especially in rear of mammary gland.

JUDGMENT. If animal slaughtered in early stages of disease, carcase may be passed. In later stages, carcase bleeds badly and will soon emit a sickly odour. Can be tested by probing along femur bone and in this condition should be condemned.

## Necrosis

Causes death of part of any tissue affected; marked by white colouration; firm to touch; gangrene or sapræmia may develop.

JUDGMENT. With simple form, condemn affected part or organ. Judge according to condition of carcase generally.

## Nephritis

Inflammation of kidneys; caused by complications of swine fever, penetration of organisms into urino-genitary tracts, and drugs (turpentine). Several forms, viz.:

(*a*) *Acute.* Enlarged with blood, tense capsule which strips readily, small hæmorrhages in substance.

(*b*) *Chronic.* Paler, larger, surface hæmorrhages, dark and congested. Irregular in shape, capsule strips readily. Flesh often emaciated, dropsical, sets badly.

(*c*) *Purulent.* Abscesses form, each surrounded by red congested area.

(*d*) *Pyelo.* Inflammation of kidneys, abscesses on cortex, pus present.

(*e*) *Fibro-plastic.* White wedge-shaped areas in organ; found in calves; spots are white, fibrous tissue; result of sub-acute inflammation.

JUDGMENT. Organs affected condemned in all cases. If carcase is dropsical, fevered or septicæmic, it is condemned with organs.

## Ostitis

Inflammation of bones.

JUDGMENT. Judge on merits. Carcase and organs condemned if fevered.

## Pericarditis

Inflammation of heart sac; becomes inflamed and filled with pus or fluid. Arises chiefly from traumatic injuries or complications of another disease.

JUDGMENT. Heart only condemned unless fever or septic *conditions present when carcase is condemned.*

## Peritonitis

Inflammation of peritoneum; mostly occurs in cattle and sheep; caused by penetrating wound of abdominal wall, perforation of stomach or intestines, or septic inflammation of uterus in cows and sheep; soft yellow layer of exudate appears on surface; adhesions formed; septicæmia may ensue.

JUDGMENT. Carcase and organs condemned if fever or septicæmia present. *Slight adhesion, strip peritoneum.*

## Pleurisy

Inflammation of pleura; may be secondary to diseased condition of lungs or caused by fracture of rib or by penetration of some foreign body. In initial stages, pleura congested in parts; becomes dry, opaque, grey; inflammatory exudate from false membrane, which may be turbid, bloodstained or purulent; putridity occurs after rupture of œsophagus, exudate being thick, creamy, foul; adhesion between parietal and visceral layers may occur. In purulent form, flesh is soapy to touch, dark in colour, flaccid.

JUDGMENT. If fevered or purulent, take carcase. In other cases, strip and condemn affected part.

## Pneumonia

LOBAR. Inflammation extends to one or more lobes; lung tissue sinks in water; airless and solid. Has four stages:

(*a*) *Congestion.* Dark red, less resilient, abnormally moist, blood wells out on incision.

(*b*) *Red Hepatisation.* Solidifies, does not crepitate (crackle). Dark red, granular.

(*c*) *Grey Hepatisation.* Not so firm, greyish-red or yellow, non-crepitant, extensive areas affected.

(*d*) *Resolution.* Softening of consolidated area, pus exuded, gangrene may result through entrance of putrefactive organisms.

BRONCHO. Majority of cases due to *Strongyli*, "verminous" (see page 42), or due to infiltration of foreign bodies. Part of lung consolidated, sinks in water; frothy mucus exuded from cut surface; solid and projecting grey-yellow or grey-pink patches. Seldom causes alteration in flesh.

JUDGMENT. Lungs only condemned unless symptoms of other diseases, *e.g.*, swine fever, or signs of fever present when carcase is condemned.

## BLOOD DISEASES

### Anæmia

Deficiency in blood ; red cells below normal number ; flesh paler than normal, flabby, dropsical, emaciated ; small hæmorrhages sometimes found on muscles and serous membranes.

JUDGMENT. If pronounced, carcase and organs condemned.

### Hydræmia

Dropsy. Blood denuded of solid content ; fluid part increased ; is pale, thin, watery ; animal usually emaciated ; fluid accumulates in tissues, dropsy ; flesh does not set ; pits on pressure ; is pale, watery, flabby, soft ; dropsy accompanies many other diseases.

JUDGMENT. Carcase condemned in cases of marked dropsy.

### Jaundice

Caused by stoppage of bile ducts, usually by flukes or gall stones ; bile enters portal circulation and passes through body, giving greenish-yellow tint to skin, mucous and serous membranes ; liver becomes light yellow.

JUDGMENT. Carcase and organs condemned.

### Leucocythæmia

Permanent increase in number of white blood corpuscles ; increase accompanied by enlargement of glands and spleen and alteration in bone marrow ; flesh pale, soft and watery. Rarely seen in food animals.

JUDGMENT. Carcase and all organs condemned.

### Milk Spots

Small, white star-shaped spots found in livers of swine ; condition of cirrhosis.

JUDGMENT. If numerous, take liver.

### Rheumatism

Animals attract attention by their lameness and inability to rise ; joints contain clear fluid or pus ; look for abscesses, dropsy, and inflammation of side laid on ; joints swollen and painful ; emaciation may be evident.

JUDGMENT. Consider on merits. Joints affected, removed and condemned. If general emaciation, carcase and organs condemned.

## Rickets

Usually found in pigs; long bones softer than usual, cartilages thickened; calcification proceeds irregularly; flesh pale and watery; animals usually in poor condition.

JUDGMENT. Carcase judged on condition of flesh. If malnutrition is present, carcase and organs condemned.

## Tumours

Neoplasms. Two types, malignant and benign.

MALIGNANT TYPE characterised by rapid growth; are spread by blood stream and are encapsuled. Types are:

(*a*) *Carcinoma.* Found on skin, mucous membranes, in liver, and intestines (any secretory organs), in œsophagus; not sharply defined; may be hard or soft; affect the lymphatics of affected area.

(*b*) *Sarcoma.* Grey or pinkish-white; unencapsuled; may appear similar to lymph gland; usually found on skin or mucous membranes; may be fibrous or ossified; multiply on occasion, secondary deposits being formed in lungs and liver; may be confused with tubercles but never calcify.

JUDGMENT. May be necessary to condemn entire carcase especially in pigs. In any case affected organ is condemned and rest of carcase carefully examined.

BENIGN TUMOURS of several types, viz.:

(*a*) *Angiomata.* Dark red structure; deeply embedded; resemble engorged blood vessels; size from cherry to walnut; most often found on liver.

(*b*) *Fibromata.* Found usually under skin and mucous membranes; rounded with fibrous capsule; hard or soft; whitish or pink in colour.

(*c*) *Lipomata.* Usually found in abdominal cavity; fatty tumour reaching colossal size; well defined, rounded; sets firm after death.

(*d*) *Papillomata.* Usually found in ox. Known as "Angleberries." Branched, warty growths; usually pear-shaped; generally found in pharynx and œsophagus, attached by narrow end anywhere on mucous membrane.

JUDGMENT. In case of angiomata, liver condemned; with other types, affected part cut away.

## Uræmia

Caused by rupture of bladder due to retention of urine; tissues become affected and charged with urinous fluid; flesh offensive smelling; smell emphasised when meat is cooked.

JUDGMENT. Condemn carcase and organs.

## BACTERIAL DISEASES

### Actinobacillosis

Similar in appearance to actinomycosis and may be mistaken for this disease; symptoms, lesions and judgment as in case of actinomycosis (see page 38).

### Anthrax

In cattle. Caused by bacillus of anthrax; rod-shaped under microscope. Deadly disease; highly communicable to man; infection takes place by mouth or wounds in skin; incubation period about seventy hours; presence of bacillus in blood stream causes lesions to be distributed throughout entire body and organs.

LIVE SYMPTOMS. Animal dull and apoplectic or intensely excited or uneasy; occasional shivers; blood trickles slowly from nostrils and anus; swelling under neck, hot at first, then cold and clammy; animal goes into convulsions then suddenly drops dead.

LESIONS. Flesh is pale salmon colour; blood, damson hue; clots imperfectly. Muscles flaccid and soapy to touch; numerous widespread hæmorrhages due to bursting of small capillaries; liver and kidneys engorged with blood; pleura and peritoneum ecchymosed; lymphatic and mesenteric glands congested or quite black; spleen abnormally enlarged, pulpy, and usually ruptured; resembles black currant jelly. Sudden death with œdema of throat and rupture of spleen are evidence of disease. Microscopical evidence conclusive. Note that on no account should carcase be opened up.

In pig. Care should be taken not to expect similar symptoms.

LIVE SYMPTOMS. Swelling of throat and neck; difficult breathing and swallowing; regurgitation of food frequent.

LESIONS. Confined to throat which is much swollen; very flabby, looking on section like old bruise; meat glands and organs full of blood; whole smells offensively; spleen not normally enlarged.

JUDGMENT. Notifiable disease, special Order. Carcase and organs condemned.

### Bacillary Necrosis

Lesions found scattered throughout livers of cattle, which are enlarged, as yellow spots from pin head to shilling in size, surrounded by well-defined red ring. Pus of greenish colour may collect beneath capsule formed round necrotic area. May be mistaken for tubercular deposits.

JUDGMENT. Condemn affected organ.

### Black Quarter

Caused by black quarter bacillus ; chiefly attacks cattle and young sheep ; man and fowl immune ; lesions confined to fore and hind quarters, hence name. Organisms come to rest in tissues and set free gases which distend skin in form of crackling tumours and force muscular fibres apart. Muscles dark and stringy ; rancid disagreeable gas escapes when cut ; whole is infiltrated with a bloody seriosity ; glands of affected part often hæmorrhagic ; internals organs congested. In marked cases, systemic effusion of blood and discolouration of tissues with congestion. In sheep, tumours may be almost imperceptible ; animal may die before disease is suspected. Lesions must be carefully distinguished from ordinary bruises.

LIVE SYMPTOMS. Swelling, heat and pain ; animal walks lame. Bloody-looking appearance of tissues beneath hide may suggest anthrax ; absence of splenic enlargement assists diagnosis. Emphysema, a condition in which air or gas gets under skin and distends tissues which crackle when pinched is keynote of disease.

JUDGMENT. Although disease is not transmissible to man, total condemnation of carcase and organs is essential as flesh has rancid odour and quickly putrifies.

### Braxy

Bacterial disease ; attacks young sheep in their first winter ; body of dead animal swells rapidly owing to gas ; soon putrifies. Third stomach full of hard, undigested food ; walls of fourth stomach show red and blue patches ; carcase gives very offensive smell, especially kidney fat. Musculature boggy with bloody œdema ; blood stains on most of organs ; lungs often congested ; blood-vessels contain black-looking blood ; abdominal cavity often filled with water, tinged with blood ; death occurs from blood poisoning or suffocation. Not to be confused with water or turnip braxy. Braxy mutton looked upon as delicacy in some parts of Scotland.

JUDGMENT. Carcase and organs to be condemned.

### Calf Diphtheria

Grey necrotic lesions covered with exudate found on mucous membrane of mouth, pharynx and larynx. Trachea and digestive tract often affected. Lesions often localised.

JUDGMENT. Condemn affected organs. If lesions widespread and carcase emaciated and dropsical, carcase and organs condemned.

### Caseous Lymphadenitis

Occurs in imported mutton from Argentine ; infrequently in Australian supplies. Resembles tuberculosis in some respects ; known as pseudo-tuberculosis. Lesions those of localised inflammation ; formed into nodule with capsule ; contents purulent and greenish in colour ; at a later stage dry up. Differs from tuberculosis in that there is no calcification. Common sites of infection are prescapular, popliteal, precrural and inguinal glands ; also found in lungs and glands of lung ; in liver, spleen, kidneys, bones and muscles. Nodules differ from old hydatid cysts in that these latter can be picked out and walls of cyst left behind ; also hydatid cysts frequently calcify.

JUDGMENT. Carcase and organs condemned if disease is present.

### Glanders or Farcy

Disease attacking horses, asses or mules ; transmissible to man and causing dangerous swelling of glands. *Bacillus mallei* is causative organism. Three types, viz. :

(*a*) ACUTE. Symptoms are rigors, shivering, high temperature and pulse ; purulent discharge from nose ; diarrhœa. Animal dies.

(*b*) CHRONIC. Ulceration of respiratory passages ; adjoining glands swollen, becoming hard and fibrous ; nasal discharge, lungs ulcerated.

(*c*) FARCY. Nodules beneath skin over limbs and at root of tail ; glands affected and limbs swell ; nodules discharge pus and develop into ulcers.

JUDGMENT. Notifiable disease ; special Order. Carcase condemned.

### Johne's Disease

Form of chronic enteritis found in cattle, sometimes in sheep, never in swine. Lesions take form of grey and very corrugated condition of intestinal mucous membrane and mesenteric glands ; bowel substance thickened ; food absorption interfered with ; animal has diarrhœa and wastes ; glands usually enlarged and watery ; due to Johne's bacillus which is acid-fast.

JUDGMENT. If only intestines and glands affected, carcase passed. If carcase is emaciated, it is condemned.

### Louping Ill

Attacks sheep ; seldom seen in England, common North of Tweed. Paralytic symptoms with dullness, spasms ; gas develops in abdomen ; hæmorrhages along intestines. Flesh

of animals killed at onset usually sound; after paralysis commences, carcase becomes emaciated; flesh flabby and watery.

JUDGMENT. In early stages, flesh may be little altered and may be passed. If accompanied by dropsy and emaciation, carcase and organs condemned.

### Malignant Œdema

Seldom seen in animals; œdema and emphysema of subcutaneous tissues together with gangrene; meat not so dark as in black leg; spleen may be slightly enlarged; carcase may emit putrefactive odour.

JUDGMENT. Carcase is generally fevered and should be condemned.

### Sheep-pox

Lesions appear as red pimples which suppurate and form pustules; may become confluent or dry up and form scales; found on hairless parts, mouth, nostrils, skin on thighs, shoulders and breast.

JUDGMENT. Notifiable disease, special Order. Carcase condemned.

### Swine Erysipelas

Generally affects adult pigs, over four months. Caused by bacillus found in blood, spleen, lymphatics and bone marrow.

Two types, viz.:

(*a*) *Acute.* Symptoms are loss of appetite; red or black patches on ears, thighs and hocks; reddening of eyes, fever; constipation followed by diarrhœa; convulsions. Flesh is pale; hæmorrhagic spots spread throughout musculature; rigor mortis slight or absent; flesh soapy to touch; spleen and liver enlarged; gastric and intestinal membranes show swellings, congestion and abrasion *but no ulcers.*

(*b*) *Chronic.* Glands congested; kidneys show small hæmorrhages; are inflamed. Heart shows vegetative growth on valves, this being diagnostic in 99 per cent. of cases; valves on left most generally affected. Not communicable to man.

JUDGMENT. In early stages, carcase generally passed; condemned with organs when disease is acute.

### Tetanus

Known as "lockjaw." Mostly found in horse but all domestic animals and men are susceptible. Evidence of disease shown by stiffening of limbs and spasms; animal sweats; neck muscles stand out. Bacteriological examina-

tion only certain method of diagnosis. Small hæmorrhages and some degeneration in later stages of disease.

JUDGMENT. In later stages of disease, carcase will not set and should be condemned.

**Tuberculosis**

Affects cattle and pigs mainly, sheep and goats rarely. Causative organism is tubercle bacillus. When organism enters vein or thoracic duct, lung first affected; in portal vein, liver first affected. These two organs usually diseased in all generalised cases. Other organs affected are spleen, kidneys, in that order, with prescapular and inguinal glands, udder, bones and joints following. Muscles rarely affected as organisms are filtered out. In cattle up to four years of age, spleen affected more than kidneys and conversely if over four years. Counteraction of leucocytes and causative organisms causes formation of giant cells; connective tissue laid down to form fibrous capsule; this shuts off blood supply; necrosis, caseation and calcification result. Spread of lesions due to defective encapsulation of affected part. Nodules vary in size from pea to a nut; consist of yellowish centre of caseous material in cows and of greyish material in pigs. In cows, pharyngeal glands more commonly affected than submaxillary; in pigs, reverse is case.

In examining carcase, examine glands of head, then pleura, peritoneum and inguinal glands. Glands of organs, particularly those of lungs, finally those of vertebræ and sternum. Common sites are bronchial and mediastinal glands, lungs and pleura, peritoneum and mesenterics, kidneys and udder. Usual manner if infection is lungs, lymphatics and pleura simultaneously; or lungs, lymphatics and serous membranes only. In bovines, spleen may remain unaffected except in advanced cases, though capsule may suffer. Uterus and intestines also attacked in advanced cases.

PRIMARY LESIONS of lungs show tissues becoming tough in patches, with caseous patches or areas at apices or lower borders.

SECONDARY LESIONS are miliary with uniform distribution of pale yellow tubercles. Glands such as bronchial, mediastinal, sternal and intercostal become enlarged, œdematous, caseous and calcified. May be first to show change.

PLEURA is infected from lungs and lymphatics; "grape disease"; small nodules combining to form large, warty growths, caseous or calcified. Sometimes primary when lymphatics only are affected. Lesions may cause fibrous pleurisy and lungs when removed bring pleura away with them in patches.

Peritoneum may be subject to secondary infection from pleura, etc.; may have primary infection from mesenteric glands without any signs in lungs.

Liver shows usual lesions but glands show changes first.

Spleen not often affected.

Kidneys may be enlarged and show white or yellow caseating tubercles.

Intestines may show lenticular ulcers with raised edges.

Udder may show diffuse, firm enlargement of organ, usually posterior quarter, fibrous, hard, caseous or calcareous tubercles.

Bones show reddish-grey marrow and are granulatory with caries; cavities of caseation.

In live animals, all tubercular swellings are painless, hence difference between these and abscesses for diagnosis. In pig, live symptoms are cessation of growth, loss of weight, pale mucous membranes, later vomiting, eyes sunken, diarrhœa, belly pendulous (intestinal). Usually under one year of age. Generalised form found more often than in cattle; bones and joints commonly affected. Examine submaxillary and pharyngeal glands, white fibrous nodules; inguinals; strip kidneys from capsule, mesenterics, spleen, often affected; have carcase split down and examine vertebræ.

Judgment. Affected organs condemned. If any one gland of head affected, head and tongue condemned. Carcase and all organs condemned when:

(*a*) Tuberculosis present with emaciation.

(*b*) Generalised tuberculosis.

Disease said to be generalised when there is:

(*a*) Miliary tuberculosis of both lungs with tuberculosis elsewhere.

(*b*) When lesions are multiple, acute and progressive.

(*c*) When there is widespread and multiple infection of lymphatic glands of carcase.

(*d*) Where pleura and peritoneum together with carcase glands are affected.

(*e*) Where in addition to tubercular lesions in respiratory tract or in digestive tract, lesions are present in one of the following: spleen, kidney, udder, uterus, testicle, brain, spinal cord or their membranes.

(*f*) Congenital tuberculosis in calves.

All other cases to be regarded as localised.

## Urticaria

Known as "Diamonds"; form of swine erysipelas. Found only in pigs; is simple fever. Carcase marked with more or less perfect red or dusky squares measuring an inch across. Caused through chill or indigestion; may be accompanied

by inflammation of lungs and mucous membranes of intestines. Slight ailment may appear and disappear overnight. Delay slaughtering.

JUDGMENT. Examine for other diseases ; if sound, carcase passed.

## DISEASES DUE TO FUNGI AND VIRUSES

### Actinomycosis

Chiefly attacks cattle but sheep and pigs affected ; transmissible to man ; known as " wooden tongue " or " lumpy jaw." Resembles tuberculosis. Caused by ray *fungus* infection ; usually by mouth. Chief sites in order of precedence are jaws, especially where there are decayed teeth, pharyngeal and submaxillary glands, tongue, roof of mouth and udder. Lesions take form of warts, nodules, tumours or dense hard proliferation. Tumours on section show green pus and tufts of ray fungus. Usually appear as greyish firm nodules size of barley grain. On incision, smaller yellowish centre of soft material found ; centre may be absent or may be as large as threepenny piece ; very similar to tubercular nodule. Glands may have white, well-defined nodules or contain much pus ; tongue shows dense fibrous proliferation ; becomes very hard ; nodules found on incision. Roof of mouth usually has patch like raw, red, raised ulcer. Udder becomes and remains very hard. Jaw becomes swollen and carious due to growth in jaw ; pus discharged. Lungs may become affected. Possible for any part or organ of body to be attacked, but those named are usual. Chief point of distinction as against tuberculosis is absence of caseation. Disease may become generalised but is generally local in character.

JUDGMENT. Where carcase is not emaciated or if disease not generalised, affected parts only condemned. If generalised, carcase and organs condemned.

### Aspergillus Pneumonia

Due to *Aspergillus fungus* which causes patches of hepatisation through pneumonia in lungs of cattle. Lungs have mottled appearance.

JUDGMENT. Condemn lungs.

### Cattle Plague

Known as " Rinderpest." Confined to alimentary tract. Flesh dark with disagreeable odour ; crackles on pressure, due to air in tissues. Lining of air passages inflamed ; yellow cheesy deposit may be found in throat ; intestinal

tract inflamed ; on cæcum are series of grey strips, so-called " zebra markings " ; first three stomachs may be congested ; liver swollen and kidneys slightly congested ; dark patches on heart. Eruptions may be seen on hide, back, loins, inside thighs, and on teats of cow. In milch cow, mild secretion ceases. Very rare disease ; fatal in ten to twelve days.

JUDGMENT. Notifiable disease, special Order. Carcase condemned.

### Contagious Pleuro-Pneumonia

Very seldom seen in this country ; characterised by inflammatory changes in lungs of ox ; lesions mostly confined to chest walls. Chest usually dropsical ; glands swollen and watery. In acute cases, flesh is fevered and soapy to touch ; does not set well. Lung tissue consolidated ; pleura covered with yellow exudate. Left lung most frequently affected. Flesh generally unmarketable.

JUDGMENT. Notifiable disease, special Order. Carcase condemned.

### Foot and Mouth Disease

Attacks oxen and sheep. Sporadic and highly infectious disease ; due to filterable virus ; incubation period two to three days. Eruptions appear on pad, tongue, in mouth and sometimes in throat and nostrils, and in feet just above clefts. Commonly appear on teats and udder of cow. Animal has staring coat, rise of temperature, restless on feet and makes sucking noise with mouth. Eruptions appear like water blisters ; possibly as large as hazel nut ; may be confluent ; those in mouth soon burst leaving raw, red sores. In feet, blister contents burrow into hoof which may be loosened and shed. Vesicles on teats not to be mistaken for excrescences due to much handling. In sheep, eruption may take form of red swelling exuding gummy substance. Head or feet may be affected, or both together. May be mistaken for foot rot.

JUDGMENT. Notifiable disease, special Order. Carcase condemned.

### Malignant Catarrh

Found in ox. Foul smelling discharge from nose ; membranes of mouth, larynx, pharynx and bowels congested and inflamed. In advanced cases, nasal cavities ulcerate and suppurate. Hæmorrhages in interior of eye with acute inflammation. May be confused with cattle plague ; no foul discharge with latter.

JUDGMENT. Carcase condemned.

### Swine Fever

Known as "Red Soldier," "Purples," or "Hog Typhoid." Alive, symptoms are husky cough, loss of appetite, thirst, prostration, high temperature, constipation followed by profuse diarrhœa with traces of blood and crusts from ulcerated intestines, red or patchy violet eruption of skin and inside of thigh, sometimes paralysis of hindquarters. Lesions are eruption of skin, ulcerations of intestines, particularly on cæcum and around ileo-cæcal valve which are keynotes of disease. Ulcers appear to be oblong, about size of sixpence, necrosed in centre and varying in colour from dark grey to black with dirty yellow border. Liver, spleen and kidneys often show cloudy swellings and multiple necrosis. Lymphatics congested (strawberry glands). Kidneys show small hæmorrhages, lungs inflamed or consolidated. Hæmorrhages always to be found beneath shoulder blade. In carcase without organs look for congested glands, hæmorrhages on kidneys and patches on skin.

JUDGMENT. Notifiable disease, special Order. Carcase and organs condemned.

## SUPPURATIVE DISEASES

### General

With all suppurative diseases great care is essential in giving correct judgment. Many outbreaks of food poisoning have occurred due to the consumption of flesh of animals suffering from such diseases and this should always be borne in mind when dealing with such conditions.

### Bacterial Endocarditis

Ulcers form on heart valves; secondary abscesses may occur on lungs and spleen.

JUDGMENT. Condemn affected organ if rest of carcase is satisfactory.

### Navel Ill or Joint Ill

Affects all young animals; particularly calves. Due to umbilical cord being left to heal naturally; sometimes results in septic conditions arising. Cord does not heal but continues to discharge and abscesses may form in tissue. May lead to joint ill or umbilical pyæmia. Organisms develop along umbilical vessels; form multiple abscesses in liver; by general circulation, other organs invaded. Lesions found in spleen, liver, kidneys, sometimes in muscles. Joints,

particularly hocks and knees, are swollen ; synovial membrane contains a turbid fluid but no actual pus.

JUDGMENT. Carcase and organs condemned.

### Osteomyelitis

Suppuration of bone marrow ; abscesses on hooves and joints ; marrow darkened red or chocolate colour in early stages ; becomes purulent and fluid later.

JUDGMENT. Carcase and organs condemned.

### Sapræmia

Due to entrance of saprophytic organisms into uterus or lung wherever dead tissue exists. Tissue putrifies and septic intoxication results ; acute fever and diarrhœa occurs. Usually other pathogenic processes present in addition.

JUDGMENT. Carcase and organs condemned.

### Septic Mastitis

All quarters of udder excessively swollen ; minute hæmorrhages of intestines, pleura and epicardium. Liver cloudy, yellow and soft ; heart and kidneys cloudy. Condition of animal becomes poor ; necessary to slaughter.

JUDGMENT. Carcase and organs condemned.

### Septic Metritis

Inflammation of uterus and womb ; caused by entrance of bacteria through genital organs or by organisms of putrefaction from fragment of placenta adhering to wall of womb. All parturient animals affected. Uterus walls thickened and congested ; reddish-brown fluid in cavity ; œdema ; congestion of surrounding tissues ; local peritonitis. Lips of vulva often dropsical. Lungs may be affected with putrid pneumonia ; dark and foul smelling. Serous membranes generally ecchymosed with foul-smelling fluid in cavity. Flesh generally fevered ; carcase usually badly bled and repulsive.

JUDGMENT. Carcase and organs condemned.

## PARASITIC DISEASES

### Definition

Parasites are organisms which are incapable of leading an independent existence but live and derive their nutriment from other animals termed their hosts. May be divided into five classes, viz. :

(*a*) Nematodes (round worms).
(*b*) Cestodes (flat worms).
(*c*) Trematodes (flukes).

(*d*) External parasites.
(*e*) Other parasitic diseases.

Parasites cause irritation, often extreme; destroy affected organs or render flesh unfit for food; carry disease. **Few are** transmissible to man.

NEMATODES

### Ascaridæ

Different varieties found in small intestines; generally in pigs, rarely in cattle or sheep; cylindrical with pointed ends, white or yellow in colour, about thickness of quill; measure 4 to 10 inches in length.

JUDGMENT. Sour and disagreeable odour emitted when present in large numbers; flesh permeated and should be condemned. Taste of meat rendered unpleasant.

### Echinorynchus gigas

Long round worm inhabiting small intestine of pig; causes small abscesses size of hemp seed; give serous membrane pearly appearance. Uncommon in British swine; most common in those of U.S.A. Intestines rendered useless for sausage casings; sometimes perforated causing peritonitis.

JUDGMENT. If peritonitis has developed, carcase and organs are unfit for food and should be condemned.

### Œsophagustomum columbianum

Known as "Pimply Gut." Minute round worm found in cattle and sheep; inhabits intestines and produces greenish-yellow nodules, ranging from size of pin head to hazel nut. Each nodule contains one worm surrounded by cheesy material. Large number cause anæmia. Intestines unsuitable for sausage casings.

JUDGMENT. Affected organs condemned. If emaciation pronounced, carcase and organs condemned.

### Onchocerciasis

Australian disease; also occurs in U.S.A. Lesions caused by worm, 1 inch long, resembling large silkworm chrysalis. Found in cattle just below stifle joint and embedded in brisket. Forequarters from Australia sometimes seen minus brisket with affected part cut away; also hindquarters. Parasite *Onchocerca*; rarely found now.

JUDGMENT. Affected portions of carcase cut away, rest passed for consumption.

### Strongyli

Known as Hoose. Seven types, viz.:

(*a*) *Micrurus*. White thread-like worm, 1 or 2 inches

long; found in lungs and bronchial tubes of young cattle; forms pearly patches.

(*b*) *Paradoxus.* As *Micrurus* but found in swine. May give rise to pneumonia.

(*c*) *Filaria.* As above but trifle thicker; found in sheep and goats; may give rise to pneumonia.

(*d*) *Rufescens.* Commonest and most important; reddish-brown and thread-like; female little longer than male; found in sheep and goats, occasionally in cattle. Eggs laid beneath pleura and in lungs; form firm grey nodules; may be brown or green on surface; embryos found in centre of nodules on incision; nodules have hard, gritty feel.

(*e*) *Capillaris.* Found in lungs of sheep and goats; causes bronchitis and broncho-pneumonia.

(*f*) *Contortus.* Found in fourth stomach (abomasum) of cattle, sheep and goats; draws its nourishment from blood; its presence in large numbers may cause diarrhœa, anæmia and wasting.

(*g*) *Convolutus.* Found coiled up under mucous membrane of fourth stomach (abomasum) of cattle; appears as a small lenticular nodule or nodules; most frequently found in young calves causing diarrhœa and emaciation.

JUDGMENT. If present in large numbers, may cause dropsy, œdema or emaciation, when carcase and organs are condemned. Usually sufficient to condemn entire lungs or cut away affected portions.

### Trichina Spiralis

Larvæ of small round worm which invades muscles of man (trichinosis), pig and rat. When infested flesh is consumed, sexually immature larvæ are liberated in stomach; pass into intestine where they quickly mature sexually. Second generation produced in intestines, larvæ of which burrow through intestinal walls and come ultimately to rest in muscle fibres of neck, cheeks, tongue, shoulders, diaphragm and haunches. Affected muscles appear dusted with fine white particles; similar to sawdust. Under microscope appear as coiled-up worms in lemon-coloured swelling in muscle tissue. Uncommon in British swine. Thorough cooking will destroy.

JUDGMENT. Carcase and all organs condemned.

## CESTODES

### Cœnurus cerebralis

Cystic form of *Tœnia cœnurus* of dog; sometimes found in cattle; causes disease known as "gid" or "sturdy" in sheep. Mature bladders vary in size from canary seed to

hen's *egg*; heads appear *like* grains of sago; may be seen through transparent membrane of bladder; tissue round cyst usually destroyed; sometimes causes extreme emaciation.

JUDGMENT. Head or emaciated carcase should be condemned.

### Cysticercus bovis

Cystic form of *Tænia saginata* or *mediocanellata*, adult tapeworm found in man; life history identical with *Tænia solium*. Head possesses four suckers but no hooklets; appear in muscle on section as small, grey, semi-transparent objects from pinhead to pea in size. Heat, pickling or storage at temperatures below 20° F. for three weeks destroys. Limiting membrane of cyst is denser and grey in colour; muscles of mastication and heart are chief sites.

JUDGMENT. If generalised, carcase and organs condemned. Otherwise, condemn affected organ.

### Cysticercus cellulosæ

Cystic form of *Tænia solium* found in man. Is bladder-like worm; found in muscular fibres of pig in sacs about ¼th inch long; most favoured parts are tongue, cheek, heart, neck, chest and diaphragm in order named. Each worm is small bladder-like structure containing clear fluid within transparent limiting membrane. Infested flesh appears to be speckled with rice. If such flesh is eaten, cysts liberated by gastric juices and tapeworms develop in intestines. Head of tapeworm is well-developed rostellum which carries double circlet of 24 to 32 hooklets in addition to four suckers. Flesh of animal affected does not set well. Disease not often seen in England. Cysts *sometimes calcified* and degenerated. Heat, pickling in strong brine, and storage at low temperatures will destroy.

JUDGMENT. Carcase and organs condemned if generalised.

### Cysticercus tenuicollis

Cystic form of *Tænia marginata* which inhabits intestines of dog; mostly found in sheep, much less frequently in pigs or cattle. Often only one present and numbers in any animal are small. Size from pea to hen's egg. Fully developed bladder worm has long corrugated neck which gives structure an elongated, pear-shaped appearance. Head appears as a grey speck on bladder wall and is armed with a *double row of hooklets*. Found chiefly in peritoneal tissues; sometimes on surface of liver, lungs and heart; sometimes in liver tissue. No appreciable effect on carcase and may be picked off.

JUDGMENT. If carcase is emaciated, judge according to degree of emaciation. If in good condition, may be passed.

### Hydatid cysts

Or *Echinococcus veterinorum* ; bladder worm stage of *Tænia echinococcus* of dog. Ox, sheep, occasionally pig and sometimes man affected. Size varies from pea to orange or may be larger. Eggs ingested with food ; embryo develops in intestines ; is carried by blood stream, or bores its way to selected organ. Most common sites are liver and lungs ; heart, kidney, spleen and sometimes muscles affected. Cyst found half embedded in selected site ; has clear translucent membrane ; old cysts become opaque ; may be degenerated, caseous, calcified or very purulent ; in latter stage has greenish-yellow tint ; caseous form may be taken for encapsuled tubercle but caseation can be removed by forceps ; in tuberculosis it cannot. If embedded in lung will be hard ; roll or fluctuate between fingers. *Echinococcus multilocularis* differs only in internal structure ; known as "Pill Box" hydatid ; daughter cysts are enclosed in mother cysts.

JUDGMENT. Organs affected should be destroyed. If carcase is emaciated on account of disruption of liver functions (rarely found) it should be destroyed.

### Tænia

*Tænia expansa* and *Tænia denticulata* most commonly found in intestines of cattle and sheep ; former most important ; measures up to 20 feet long by ¾ inch broad ; latter usually about 1 foot long and head has four globular suckers ; *expansa* has four oval suckers. Tapeworms are credited with causing diarrhœa and anæmia in young animal, causing them to become emaciated and unmarketable.

JUDGMENT. Carcase condemned if emaciated.

## TREMATODES

### Distoma hepaticum

Most prevalent in cattle and sheep, rare in pig ; has been found in man. Fluke resembles miniature flat fish ; about 1 inch long and ½ inch broad ; dark brown skin, lighter in centre ; studded with delicate bristles. Invades bile ducts of liver in large numbers ; causes distension and hardened calcification ; gives rise to cirrhosis of liver. Condition recognised by borders of organ being more rounded than normal ; tissue firm and often of yellowish colour ; grates when cut ; distended bile ducts stand out as thick white cords ; contain mucus and a chocolate-coloured fluid in

which parasites may be found. Wandering flukes often found embedded in solid organs, lungs, spleen, etc. Appear as tumour about size of walnut; contain encysted parasite in dark brown fluid. May be degenerated, or calcified; former type may be mistaken for tuberculosis. *Distoma lanccolatum* is lance-shaped and shorter.

Life History. Eggs of flukes in liver are deposited on pastures where they die or are washed by rain into water supplies. Escaping the envelope, cell becomes free-swimming ciliated embryo. Seeks out certain type of snail, *Linnæ truncalata*, which acts as host; bores its way into its body. Develops here into *Reclia*; germs cells of which become *Cerceriæ*. These remain in snail for some time, then take to water; ultimately attach themselves to grasses and become encysted. When swallowed by animal, cyst dissolved by gastric juices and fluke develops. Man may be affected by eating watercress.

Judgment. Affected parts cut away. Badly affected livers condemned. In case of bad attack, carcase may be pale, set badly, or be very emaciated. In this condition condemned.

## External Parasites

### Acaridæ

Cause scab or mange in food animals; cattle, sheep (sheep scab) and pigs affected. Usually emaciation with irritation; sometimes pustule formation. In sheep scab, large crusts of serum form on back where parasites have burrowed or bitten deep. Ulcers and sores may occur. Disease may be contracted by slaughterman. Flesh of carcase not affected.

Judgment. Notifiable disease, special Order. Carcase and organs condemned, particularly where emaciated.

### Bots

Fly affects all domestic food animals; most common in sheep. Eggs laid in nostrils; maggots penetrate nasal passages and sinuses of head; great irritation and purulent discharge results. Sheep restless and may become emaciated.

Judgment. Head usually useless and condemned. Carcase judged on merits.

### Maggots

Larvæ of certain flies often deposited on wounds. Common seat is anus which is excoriated after diarrhœa. Tissues underlying skin may be disfigured.

Judgment. Condemn affected portion.

### Warbles

Caused by warble fly. Eggs laid on hairs of hind legs of cattle ; maggots pierce skin and travel to gullet ; develop and enter neck muscles ; swellings size of pigeons' eggs formed ; maggots breathe through aperture in swelling and escape from host's body by this means ; appear on back under skin. Flesh may change to dark green colour within a few hours of slaughter ; hides spoiled.

JUDGMENT. Any damage to flesh can normally be trimmed away, rest of carcase being passed.

## OTHER PARASITIC DISEASES

### Coccidia

Form white patches ; size from pin head to size of pea ; affect liver and intestines ; contain cheesy matter ; cause intestinal inflammation. Three principal types, viz. :

(*a*) *Coccidium zurini.* Found in cattle. Causes acute dysentery and enteritis.

(*b*) *Coccidium perforans.* Found in calves and sheep. Causes diarrhœa.

(*c*) *Coccidium fuscums.* Found in pig ; shot-like nodules formed.

JUDGMENT. Organ or portion of carcase affected condemned. If emaciated, carcase and organs condemned.

### Red Water

Known as Texas fever ; cattle only affected. Characterised by disintegration of red blood cells and appearance of altered pigment in urine ; small hæmorrhages found under skin and in internal organs ; spleen enlarged, maybe twice normal size. Kidneys are congested, sometimes show pigmentation ; urine in bladder highly coloured and albuminous ; fat and tissues may be bile-stained. Flesh is pale and has macerated appearance ; certain parts show intra-muscular hæmorrhages. Anæmia may follow ; flesh pale, flabby and watery.

JUDGMENT. Carcase condemned.

### Sarcosporidia

Affect all domestic animals, notably sheep and pig.

*Sarcocysts* found embedded in musculature, especially if in poor condition. Spindle-shaped bodies, about $\frac{1}{8}$th inch long ; looked upon as spores. Type present in swine requires microscopic identification. Calcify and appear like trichinæ ; lie along axis muscle. Do not appear to affect human beings.

*Balbianæ* are crescent-shaped bodies ; vary in size from

barley grain to hazel nut. In severe cases, musculature may become inflamed and œdematous ; tongue, pharynx, neck, trunk are affected mostly. Very uncommon ; occurs in cattle, pigs and goats ; rarely in sheep.

JUDGMENT. If cysts can be seen with naked eye and are generalised, carcase condemned. Removal of affected parts usually sufficient.

## DEGENERATIVE CONDITIONS

### Cloudy Swelling

Liver, heart and kidneys become enlarged, grey in colour and opaque ; dull appearance.

JUDGMENT. Condemn affected organ.

### Fatty Degeneration

Caused by conversion of cell albumen into oil ; often due to flukes as complication of cirrhosis ; organ smaller and softer than normal ; tissue pale, yellowish, friable and has greasy feel.

JUDGMENT. Condemn organ (normally heart, liver or kidneys).

*Note.* The above two conditions are often associated with serious general diseases and this should be borne in mind.

### Fatty Infiltration

Liver affected ; frequently enlarged ; accompanied by cirrhosis ; yellow in colour ; softer and greasy to touch.

JUDGMENT. Organ condemned.

### Melanosis

Dead black condition of flesh found anywhere in carcase ; caused by faulty pigmentation ; deposits of sooty appearance may be found on lungs, liver, etc., of bovines. Appears either in solid areas or as if sprinkled lightly with paint brush.

JUDGMENT. Affected organ or part condemned. If generalised, carcase and organs condemned.

## ACCIDENTAL DEATH

### Choking

Strong nauseous odour ; blood vessels gorged ; peritoneum is bile-stained ; external appearance markedly inflamed, especially side laid on. Probe near pelvic bone and scapula.

JUDGMENT. Condemn carcase.

### Drowning

Animal presents sodden condition ; kidneys gorged and when cut exude sanguinous fluid ; suet and peritoneum show marked bile stains ; meat dull, pallid and decomposes rapidly. Flesh is soft and watery.

JUDGMENT. Condemn carcase.

### Dystopia

Difficulty experienced in calving, lambing or farrowing. Animal should be slaughtered at once. Diagnosis based on bruised and blood-stained appearance of region of pelvis. Slaughtering may be delayed until injury to uterus causes inflammation or animal dies.

JUDGMENT. Merits or demerits of carcase judged by manner in which it sets. Care necessary on account of probable fevered condition.

### Suffocation

Carcase presents scarlet appearance due to engorged veins and capillaries ; flesh black with velvety feel and unpleasant odour. Congestion of lungs and bile staining complete diagnosis.

JUDGMENT. Condemn carcase.

## IMPORTED MEAT

### General

Large quantities of chilled and frozen meat imported annually from Argentina, U.S.A., Australia, Uruguay, New Zealand, Brazil, and South Africa. Beef, mutton, lamb, pork and offals imported. Chilled meat now subjected to gas storage in refrigerating chamber ; air contains 10 per cent. carbon dioxide ; meat arrives in better condition and keep its clean appearance. Boneless beef, quartered and frozen hard, now being imported in large quantities.

Carcases after dressing are allowed to hang twenty-four to thirty-six hours to allow body heat to escape ; failure to do this results in bone-taint around pelvic bones. Carcases then quartered, wrapped in muslin, pre-cooled before being loaded into refrigeration chambers for journey to this country.

### Inspection

Appearance of imported meat detailed on page 8. Meat after thawing weighs more than English meat ; muscle usually wet and pale. Offals much the same whether chilled or not. Livers and kidneys soft and watery, sometimes lose much of their flavour ; frozen livers yellowish-brown in substance.

Imported meat must be labelled as such. Usual to inspect 10 per cent. of carcases and offals. Certain conditions which may be found are :

(*a*) Brine Stained

Buff to greenish-black stain ; wet even in cold chamber ; stained portions usually cut away in beef. If stained portions are large in sheep, carcase condemned.

(*b*) Bone Taint

Known as "heated" ; putrefactive changes in region of pelvic bone and shoulder blade ; due to retention of body heat when refrigerated ; usually discovered after quarter has been thawed out ; may be discovered by inserting skewer into region of aitchbone when smell is evident on withdrawal. Affected portions only condemned. Kidneys sometimes greenish in colour due to retention of body heat in fatty capsule ; should be condemned.

(*c*) Moulds. Three types, viz. :

*Black.* Known as "Blackspot." Most important. Spots olive-green to black in colour ; affect skirt and pleura of beef and legs and interior of carcases of mutton. May penetrate beneath surface and render meat unsaleable when extensive. Development affected by changes in temperature. If accompanied by putrefaction or if extensive, meat is condemned. If not extensive, remove affected portions and pass rest of carcase.

*White.* Usually easy to remove by wiping with damp cloth.

*Blue.* More often associated with putrefaction than others as they develop at above 32° F. Condemn affected portions.

(*d*) Fibrosis

Known as "Callused." Network of fibrous bands formed in musculature ; muscles paler in colour ; meat rough and leathery in texture. Affected parts condemned.

(*e*) Ammonia Taint

Imported meat sometimes found smelling strongly of ammonia. Affected meat should be condemned.

## BY-PRODUCTS OF MEAT

### Blood Drying

Blood collected during slaughter ; dried by steam and finally reduced to powder. Used for animal feeding ; sometimes mixed with molasses for this purpose. Used as base for

pigments and profitable source of income. Liquid blood used in manufacture of black puddings.

### Bone Drying

Old and new bones dried and crushed. Glycerine extracted and remainder used for fertiliser or bone meal. Hooves yield glue and manure while prussian blue dye is obtained from this source.

### Chitterlings.

Consist of large and small intestines of pig ; stomach also used ; cleaned, turned inside out and washed ; soaked in salt water, then boiled for two to four hours. Inspectors should examine for evidence of excrement denoting improper cleansing ; spoil rapidly ; when sound, are whitish-grey or pink ; firm to touch ; usually greasy. When stale, are wet and shiny and smell offensively.

### Cooked Meats

Innumerable varieties, *i.e.*, ham, pressed beef, meat and pork pies, brawn, rissoles, galantines.

NOTES ON INSPECTION

*Cooked Hams.* Skewer along bone ; smell if decomposing, which is easily noticed.

*Meat Pies.* Age can be judged from appearance of pastry ; skewer inserted through vent into pie ; wrapped pies often found mouldy or sour due to packing while warm.

*Brawn.* Decomposition evidenced by moulds and liquefaction of jelly.

COOKED MEAT PREMISES

Close supervision required ; cleanliness of premises, plant, personnel and utensils important ; quality of ingredients should be noted ; frequent sterilisation of utensils essential.

### Fat Melting

Animal fats in great demand for margarine manufacture. Clean fat melted after slaughter ; fumes should be passed into boiler flues or through condenser. Fat when melted is run into pans or containers. Lard obtained from pig fat ; candles, tallow, soap, glycerine and grease obtained from fats.

### Gelatine

Prepared from cleansed and de-greased bones ; sold either in sheets or ground ; excellent culture media for bacteria when liquefied so should be stored perfectly dry. One part

sulphur dioxide per 1,000 parts allowed as preservative. Large quantities of low-grade gelatine are imported; may be metallically contaminated.

### Glandular Products

Large quantities of medicinal preparations depend upon extracts from animal glands. Large quantities of glands are imported from abroad for this purpose as gland collection in this country has not developed to any great extent. Glands are removed immediately after slaughter and subjected to suitable treatment without delay. Examples are:

Insulin from pancreas (diabetes).
Thyroid extract from thyroid (thyroid diseases).
Splenic extract from spleen (anæmia).
Adrenalin from renal glands.

Liver extract is also manufactured for medicinal purposes.

### Gut Scraping

Intestines are important by-products particularly for sausage makers.

INTESTINES FROM CATTLE used as casings for black and white puddings and saveloys. Fat first cut off with sharp knife; care is taken not to injure gut; then turned inside out by means of running water; new external surface is scraped with edge of hard piece of wood. Gut then salted and placed in barrels with heavy weights on top. To obtain first-class article, gut should be treated immediately animal heat has left it.

INTESTINES OF SHEEP AND PIGS used for smaller sausage casings.

Process often offensive (trade is scheduled as such) as gut is in putrefactive state before it is scraped. After scraping gut is pickled for two days when it becomes inoffensive and dry. Then measured into bunches and kept in dry salt for a period after which they are ready for use.

### Lard

Obtained from abdominal fat of swine. Should be white, hard, firm and free from smell; should only contain merest trace of water. Rancidity denoted by sour smell and taste. Often adulterated with cotton-seed oil and also water. To detect lard to which water has been added, heat lard in conical glass; water sinks and lard floats on top.

### Meat Digesting

Condemned meat disposed of in digestors. These are hermetically sealed cylinders; meat cooked and sterilised

by high-pressure steam. Bone and meat meals, glue and tallow are obtained.

### Sausages

Composed of minced or chopped pork or beef, cereal, condiments, and flavouring matter. Made in variety of sizes and placed in skins or cases (see *Gut Scraping*, page 52). Sound meat of poor quality normally used for this purpose. Sulphur dioxide allowed as preservative—450 parts per million; preservatives not often used now. Saveloys, smoked sausages, polonies, luncheon sausage, liver sausage, black and white puddings are all types of sausages. When unsound, sausages are darker in colour with dry brittle skin ; can easily be broken into pieces ; contents sour and mixture may contain moulds. Cooked sausages should be dry, firm and solid when fresh. If decomposing will be soft, slimy and show evidence of moulds. To test : cut lengthways and smell; or place a little in saucer and pour over boiling water to which a little lime water has been added. This will bring out smell.

### Tripe

Stomachs are used for tripe ; emptied of contents, given rough wash and hung up in slaughterhouse to drain. Tripes forwarded to tripe boiler to be dressed ; placed in hot water for fifteen minutes ; then hung and mucous surface removed with sharp knife ; this removed brown epithelial tissue leaving fresh white surface exposed. Rinsed in water and afterwards boiled in coppers for two hours in summer and two and a half hours in winter. After boiling peritoneal layer stripped off ; tripes again soaked in cold water until ready for transit ; packed in hampers for delivery.

Fresh tripe quickly spoils and may be slightly cured by salting or pickling to preserve. If sound, should be firm, springy, cold, slightly moist. If wet and slimy, and possesses sour smell, is unsound and should be condemned. Frozen tripe which is imported in large quantities soon decomposes ; may also be affected with moulds.

Tripe dressers usually prepare ox feet (cow heel) and the feet of sheep (trotters) in similar fashion.

## PRESERVATION OF MEAT

### Canning

Beef, mutton and pork are imported in canned state into this country. Methods of treatment are dealt with in section dealing with canning of all foodstuffs.

### Drying

Practised as method of preservation among aboriginal tribes and North American Indians ; jerked beef ; meat cut into strips and dried in air ; product is hard and tough ; softened by soaking.

Dehydrated meat now being prepared ; said to be most nutritious ; granulated in form ; will probably be sold in this country at some future date.

### Pickling

Meat must be thoroughly cool ; any heat will cause flesh to putrify. Pickle consists of salt, sugar, saltpetre and water. Time taken to cure depends upon strength of brine and weight of each piece of meat to be pickled. Is roughly one day for each pound of meat. Salting and pickling check activities of micro-organisms but will not destroy pathogens. Bad brine or haste in treatment may cause putrefaction which makes meat more or less spongy, often greenish in colour, with an offensive odour.

Inspection of pickled meat may present difficulties on account of normal appearance of such meat ; once cooked, quality is easier to judge. If improperly carried out, meat is paler than it should be and slimy ; putrefaction tested by means of skewer inserted into thick substance or along bone. Old salt meat is recognised by hardness, toughness, and shrivelled appearance.

### Refrigeration

Most important method of preservation ; frozen if kept at under 18° F. ; chilled at 28·5–30° F. Butcher uses ice-box (now rarely seen) or refrigerator. Refrigeration allows large quantities of meat to be imported from abroad. Further details regarding refrigerated meat will be found on pages 8 and 9.

### Salting

Two methods, viz. :

(*a*) *Dry Salting.* Mixture of salt, sugar and saltpetre used ; rubbed well into meat ; Bacon previously cured with this method is now often pumped with brine (see below) ; then laid rind downwards and covered with fine saltpetre. Heavy layer of salt placed on top and sides of bacon stacked one upon the other ; left ten to twelve days ; curing then completed. Sides are then washed, wiped and trimmed.

Hams are usually immersed in or pumped with brine for twenty-four hours ; then taken out and pressed to remove blood from veins. Cut surfaces next sprinkled with dry salt.

Each ham is then embedded in salt, shank end downwards, for three days ; again taken out and pressed ; finally laid in salt for fifteen days, when curing is completed.

(*b*) *Pumping*. Brine pumped by means of long hollow needles into fleshy parts of meat to act as a preservative.

## Smoking

Bacon and hams smoked after dry salting (see above). Are further drained of salt for seven to ten days ; again washed, wiped and trimmed ; dusted over with pea meal and smoked for three to four days at a temperature of 85° F. ; sawdust of oak or other non-resinous wood employed. This process causes meat to shrink ; amount of shrinkage depends upon time and temperature of smoking. Smoked bacon and hams deteriorate in flavour and texture if kept too long. Decomposition detected by means of skewer inserted at shank or under aitchbone ; alongside femur in hams ; alongside blade-bone in hocks ; inside of bacon, test under backbone and ribs and in fat on bellies and loins. If sourness or taint is localised, affected portion can be cut away. Hams sometimes have a puffy, gas-inflated appearance ; due to the smoking of improperly cured hams ; detected by palpation ; if thus affected are condemned.

# POULTRY, RABBITS AND GAME

## POULTRY

### General

Large quantities of poultry of various kinds are annually killed in these islands for human food and larger quantities are imported. Those most commonly used for table purposes are fowls, ducks, geese, turkeys, pigeons and guinea-fowl. White-fleshed poultry are fowls, guinea-fowl and turkey. Dark-fleshed poultry are ducks, geese and pigeons. Capons are fattened castrated males.

Pullets are young hens commencing to lay for first time.

### Anatomy

Poultry have more cervical vertebræ than animals.

| | |
|---|---|
| Chickens . . | 14 bones |
| Ducks . . . | 15 bones |
| Geese . . . | 18 bones. |

Dorsal, lumbar and sacral vertebræ united in single bones. Coccygeal vertebræ are seven in number ; remain separate. Circulatory, respiratory and lymphatic systems similar to animals in all essential points.

Digestive system much different. Beak provided instead of lips and teeth ; tongue hard and horny ; œsophagus is large ovoid chamber ; crop acts as reservoir for food ; when full, contracts and forces food into distension of œsophagus where it is charged with gastric juices. Food passes to gizzard which has thick and horny inner membrane ; exterior composed of two compressor muscles ; function of stomach is trituration or grinding. Bird swallows grit and softened food is ground to pulp ; then passes to intestines for assimilation. Intestinal canal has two appendages which spring from large intestine. Two large air reservoirs are provided which give bird lightness and buoyancy when swimming.

Male has two testicles in pelvis which are enlarged during breeding season. Female has one large ovary containing numerous ovules, varying in development and white to yellow in colour.

### Characteristics

HEALTHY live poultry bright and active ; bright in eyes ; dry in comb and nostrils ; feathers glossy and elastic ; combs and wattles firm and brilliant red in colour.

AGED birds indicated by duskiness of comb and wattles ; dullness fading and brittleness of feathers ; raggedness of

feet ; size of claws ; beak firm and hard, cannot be bent ; thighs dark and hairy ; breastbone hard and unbending ; no down under wings ; comb thick.

Good. When dressed should be firm and elastic to touch, pink or yellowish in colour, fairly plump with strong skin and fresh smell, breastbone unbroken, feet moist and pliable.

Stale. Stale poultry lose their firmness, become bluish in colour, green over crop and abdomen, skin is discoloured and readily breaks, bird has disagreeable odour, feet stiff and dry. Discolouration usually appears on back first.

### Killing and Plucking

Fowls to be killed should be starved for twenty-four hours to allow crop and intestines to empty ; this helps carcase to keep better.

Fowls. Killed by dislocation of neck.

Ducks. Killed by dislocation of neck.

Geese. Struck on back of neck with stick and arteries severed.

Turkeys. Hit and neck dislocated.

Bird should then be hung so that blood drains from body into head. Are plucked while warm, scalding assists in removal of feathers.

Sold either plucked and drawn, or with feathers attached. Usually seen in shops in undrawn and uneviscerated condition ; keep better this way.

### Packing

Should be cold when packed. Laid breast downwards on clean straw or butter paper ; should not be drawn as birds liable to deteriorate when this is done. To inspect undrawn birds, incision is made under wing and conclusions are drawn from condition.

## Diseases

### Bacterial

Bacillary Diarrhœa. Due to *bacillus pullorum* ; highly infectious ; profuse, frothy white diarrhœa ; disseminated through egg infection ; inflammation of intestines and hæmorrhages in serous membranes.

Judgment. Carcase condemned.

Cholera. Rapidly fatal ; due to Metchnikoff's spirillium. In live bird, symptoms are white discharge from nose, eyes and mouth ; diarrhœa, fluid and greenish in colour ; ruffled feathers ; appears stupified ; stupor results in convulsions and death. In dead bird, flesh redder than normal ; flabby in appearance ; intestines contain greyish-yellow fluid which

is often bloodstained ; hæmorrhages in intestines and under serous membranes.

JUDGMENT. Condemn carcase.

TUBERCULOSIS. Fowls susceptible to both human and avian type ; spreads rapidly and by means of excretions from affected birds. Mucous discharge from eyes and nostrils ; anæmia, then emaciation ; erratic feeding and appetite impaired. Comb and wattles pale ; lameness and swelling of joints ; diarrhœa and flesh scanty ; whitish or yellowish nodules found in intestines which may be ulcerated, on liver, spleen, in lungs, on mesentery. In womb, wattles, feet and under skin of breast, lesions are stratified. If disease is confined to spleen, birds remain plump. If liver is affected, bird is generally emaciated.

JUDGMENT. If extensive disease of organs present, carcase condemned. If liver and intestines only slightly diseased, carcase can be passed.

TYPHOID. Usually affects adult birds ; due to *Bacillus gallinarum* ; live bird has ruffled feathers ; stands away from light ; droppings fœtid and liquid ; death usually occurs in few days. In dead bird, liver and spleen enlarged ; inflammation of smaller intestine.

JUDGMENT. Condemn carcase.

## Viruses and Fungi

ASPERGILLOSIS. Fungoid growth, *Aspergillus fumigatus* ; if acute, causes septicæmic conditions ; multiple hæmorrhages in viscera, serous membranes and musculature ; pneumonia may be present together with a yellowish membrane in throat ; tubercles on liver, lungs and intestines.

JUDGMENT. Carcase condemned.

FAVUS. Known as "White Comb" ; is skin disease. Caused by fungus, *Lophophyton gallinæ*, which attacks combs and wattles (numerous white spots) ; then spreads to parts covered by feathers. Feathers fall off and dirty-looking yellow crusts adhere to skin. Contagious, attacking human beings through broken skin surfaces. Dead birds exude a mouldy smell.

JUDGMENT. Condemn carcase.

FOWL DIPHTHERIA. Contagious disease caused by filterable virus. Mouth affected ; growth of grey or yellowish membrane on tongue, palate and throat ; often ulcerated ; inflammation of nostrils and respiratory passages ; enteritis often present ; fever develops in later stages. Affected birds often emaciated ; flesh soft, flabby and does not set.

JUDGMENT. Carcase condemned.

FOWL POX. Disease chiefly affects head, comb and

wattles ; verrucose nodules of various sizes appear ; sometimes nodules spread to body.

JUDGMENT. If head only affected, head and neck removed and carcase passed. If body is affected in addition, carcase condemned.

### Blood Diseases

TUMOURS. Poultry attacked by both carcinomata and sarcomata ; liver normally affected ; sometimes secondary tumours found in other parts of body. Birds affected become emaciated. Simple tumours are also found ; usally localised.

JUDGMENT. When multiple tumours are present with emaciation, carcase condemned. Simple, localised tumours can be excised and carcase passed.

### Miscellaneous

BLACKHEAD. Affects fowls and turkeys ; young birds chiefly. Birds lose condition ; excreta, yellowish-green ; liver enlarged, studded with necrotic areas of green or yellow colour ; cæcum distended and covered with cheesy material.

JUDGMENT. Condemn carcase.

CATARRHAL GASTRITIS. Known as "pip." White, horny skin growing on tip of bird's tongue ; yellowish crust ; raw, bleeding surface left when removed ; stomach affected with catarrh, foul and offensive ; diarrhœa ; emaciation.

JUDGMENT. Carcase condemned.

COCCIDIOSIS. Small, oval encapsulated bodies ; invade mucous membranes, intestines, except in goose where kidneys are affected. Acute diarrhœa, blood mixed with fæces ; thickening of intestinal walls ; emaciation.

JUDGMENT. Carcase condemned.

IMPACTED CROP. Crop inflamed, distended, contains slimy matter ; due to foreign body in crop ; flesh surrounding crop is œdematous and becomes greenish in colour. Flesh does not set well.

JUDGMENT. Carcase condemned.

ROUP. Loss of weight ; fevered condition. In dead bird, yellow slime in mouth, throat and respiratory passages ; congestion of lungs and intestinal catarrh. Flesh soft, flabby ; does not set ; emaciation.

JUDGMENT. Carcase condemned.

### Parasites

GAPES. Affects fowls and other poultry. Yawning caused by small round worm (*Syngamus trachealis*), male and female of which are joined together presenting forked appearance. Cause intense irritation and produce weakness and anæmia.

Lower half of trachea may become obstructed with worms and suffocation result. Emaciation usually present.

JUDGMENT. Condemn carcase if *emaciated*.

ROUNDWORMS. *Ascaris galli*; inhabitant of intestines; often choked with worms; affects condition of bird considerably.

JUDGMENT. If emaciated, condemn carcase.

THREADWORMS. *Heterakis gallinæ*; very common threadworm; does little harm except when infestation is severe; produces weakness and emaciation.

JUDGMENT. If emaciated, condemn carcase.

TAPEWORMS. *Tænia gallinæ*; short worms, found in intestines; severe attacks affect bird's bodily condition.

JUDGMENT. If emaciated, condemn carcase.

## RABBITS

### General

Large quantities of wild rabbits eaten in this country; shot, trapped or netted; flesh soft and nourishing; in season September to March, but sold throughout year. Domesticated rabbits also sold; flesh whiter than that of wild variety. Large quantities of fresh rabbits imported from Belgium; larger than English variety. Frozen rabbits imported from Australia, New Zealand and U.S.A.; eviscerated and cleansed; graded 1st or 2nd grade; packed in crates, cold stored and transported chilled or frozen.

### Differentiation of Rabbit and Cat

Cases recorded of cats being sold for rabbits. Differences are:

RABBIT. Elongated skull *and incisor* teeth; no fangs; short tail; straight claws. Kidneys chocolate-brown and regular in shape; right one fixed and 1 inch nearer head than left, which is floating; liver has four lobes; twelve pairs ribs.

CAT. Short, pointed ears; round skull *and canine* teeth; curved claws; kidneys both fixed and opposite each other; marked with outstanding superficial veins; lighter brown in colour; liver has seven lobes. Thirteen pairs ribs. Broader across rump.

A cat exposed for sale would obviously be dressed; rabbits usually sold with skin attached and viscera removed; skinned after sale. In two skinned animals, identification may be established by kidneys. If two hindquarters are presented, note that fibula (thin shin bone) runs entire length of foot in cat; only halfway down leg in rabbit.

## Inspection

If in good condition and fresh, flesh is firm and elastic, slightly moist, pinkish or bluish in colour, fresh smell, carcase free from bruises, fat of abdomen sweet smelling. Decomposition is demonstrated by wet, flabby condition of flesh, bluish-grey colour, offensive odour.

When in skin, staleness detected by dullness of eyes, easy removal of patches of fur, slimy sticky appearance of interior of carcase.

Imported rabbits; flesh moist and rougher than English type; Belgian variety has whiter flesh; fat yellowish in colour, sometimes affected with moulds, chiefly white, similar to those found on chilled meat; decompose rapidly and carcase unfit for food. Carcase passed if mould spots few in number; if very mouldy, carcase condemned. Sometimes mouldy rabbits emit a musty odour or are tainted; due to prolonged cold storage and detected after thawing.

Young rabbits have stumpy necks, thin soft ears, smooth and sharp claws. Old animals have thick haunches, ragged claws and dry, blunt ears.

## Diseases

COCCIDIOSIS. Small white or yellowish-white nodules or patches on liver; sometimes found in intestines; impairs nutritive condition; resembles tuberculosis to some extent but nodules are irregular in shape; follow line of bile ducts. Another type affects intestines, causing profuse diarrhœa and emaciation.

JUDGMENT. Usually localised in liver and sufficient to condemn this organ. If emaciated, carcase should be destroyed.

CYSTICERCUS PISIFORMIS. Cystic form of *Tænia serrata* in dog. Cysts chiefly found in peritoneal cavity of rabbit and hare; carried by blood stream and bore their way into tissues; adults vary in size from pea to hazel nut; hard firm nodule at end of cyst; this is chamber containing head which has double row of hooklets. Compares with *Cysticercus tenuicollis.* Rabbits affected often emaciated, cause of which can often only be surmised on account of practice of disembowelling before sale.

JUDGMENT. If badly affected, carcase should be condemned. If in good condition, cysts can be removed.

CYSTICERCUS SERIALIS. Cysts occur under skin, round shoulder and on inner surfaces of thighs; vary in size from hazel nut to hen's egg. Easily noticeable when animal is skinned. Adult worm is *Tænia serialis* of dog. Flesh often pale and flabby; carcase poor and thin.

JUDGMENT. Small cysts can be removed if meat in good

condition. Any poorness with pale flabby flesh justifies condemnation of carcase.

TUBERCULOSIS. Wild rabbits not susceptible but disease sometimes found in tame variety. Lesions on liver, lungs, spleen and intestines.

A form of pseudo-tuberculosis is sometimes found; yellowish-grey tubercles on spleen and portal glands; spleen often greatly enlarged.

JUDGMENT. As emaciation usually accompanies both these diseases, carcase should be condemned.

## GAME

### General

Two types, furred and feathered. Game birds subject to close seasons; imported game sold throughout year. Usually eaten when in initial stages of putrefaction or "high"; time before this occurs varies with type of animal or bird.

### Furred Game

DEER. Flesh known as venison; dark, blood-red with white fat resembling that of mutton; often excessively bruised or hæmorrhagic due to hunting. Hung in cool, draughty place to become "high." Venison from old animals is dry, strongly flavoured and coarse. If staleness is suspected, skewer test for bone taint can be made. Smell on skewer will quickly confirm or otherwise.

HARES. Similar appearance to rabbits but larger. Fur, light buff, white belly; hind legs and ears longer; should not be more than one year old when eaten or flesh will be dense and indigestible. Degree of decomposition allowed depends on individual taste; difficult to interfere in matter. Young hare (leveret) has small knob under first joint of fore foot. *Cysticercus pisiformis* may be present in carcase.

### Feathered Game

This group includes pheasant, partridge, grouse, snipe, ptarmigan, blackcock, woodcock, wild duck, plover, quail, teal and widgeon. Again a "high" condition is appreciated by many consumers; birds frequently offered for sale in a semi-decomposed condition. Usual practice is to seize birds whose flesh is green, soft, flabby and putrid and which are in a maggoty condition. Several diseases affect game birds. Pheasants are affected with tuberculosis and enteritis; grouse suffer from what is known as "grouse disease." Such birds show hæmorrhages in intestines and congestion of lungs and liver. All types suffer from parasites and judgment on affected birds usually depends on condition of carcase.

# FISH AND SHELLFISH

## FISH

### General

Fish are cold-blooded vertebrates ; vary considerably in size and shape ; when removed from water quickly perish. Two types, viz. :

(*a*) ***Round.*** Live at varying depths ; eye on each side.

(*b*) ***Flat.*** Live at bottom of sea ; both eyes on upper or dark side. When young, eye is on each side of head.

Propulsion afforded by means of fins, spines of which are termed fin-rays.

### Anatomy

FINS. Five types, viz. :

Dorsal fins along back.
Pelvic or ventral fins under mouth.
Pectoral fins on each side of gills.
Anal fins underneath.
Caudal fin is tail.

SKIN. Layer of connective tissue to which scales are attached ; outer layer termed epithelium.

BONES. Vertebral column passes down middle of body from brain ; long bones radiate from this ; skull is cartilaginous ; contains organs of smell and hearing ; eyes possess spherical crystalline lenses ; protrude when newly caught but collapse when exposed to atmosphere.

RESPIRATORY SYSTEM. Gills covered with gill flaps ; each side of head ; adjacent to jaws and opening into pharynx ; consist of bronchial structures where blood is brought into contact with oxygen separated from water by their action.

CIRCULATORY SYSTEM. Blood charged with oxygen passes to heart (wedge-shaped) ; organ has two chambers, auricle and ventricle ; impure blood oxygenated at gills ; passes to auricle ; leaves this to enter ventricle ; pumped through aorta to body by contraction of ventricular muscle walls.

SWIMMING BLADDER. In thorax ; filled with glassy fluid ; assists in balancing body in water.

ABDOMEN. Diaphragm ; peritoneum blackish ; contains liver and stomach ; stomach similar to elongated U-tube, joined to pharynx and mouth by smaller tube ; short intestine communicates with anus ; two roes attached to vertebral column above stomach ; yellow or pink in colour ; repro-

ductive organs ; "soft" in male, "hard" in female. Female fish usually larger than male.

MUSCLE. Large lateral muscle on either side of vertebral column and radial bones ; numerous segments ; separated into dorsal and ventral parts ; with certain exceptions (salmon) flesh is whitish in colour ; sometimes slightly bluish or pinkish. Age of fish can be ascertained by examination of thin scales which show thin concentric line for each year of growth.

## Types

(*a*) *White Fleshed.* Haddock, cod, flounders, brill, plaice, sole, turbot, whiting.

(*b*) *Red Fleshed.* Salmon and salmon trout.

(*c*) *Greasy Fleshed.* Mackerel, sprats, herrings, pilchards, sardines, eels.

(*d*) *Shellfish.* Crabs, lobsters, oysters, mussels, cockles.

## SALT WATER ROUND VARIETIES

### Cod Family

COD. Thick and rounded near head ; tapers suddenly to tail ; upper jaw larger ; has white lateral line ; greenish-brown or olive in colour with yellowish spots ; chin has barbel on end ; three dorsal, two central and two anal fins. Codling are pale green on back and show more spots than older fish.

COALFISH. Similar to cod in size ; dark slate-blue colour, almost black ; sides shading to grey on belly ; large scales ; lower jaw longer than upper ; white lateral line ; length 2 to 3 feet ; three dorsal, two ventral, two pectoral and two anal fins ; peculiar flavour.

HADDOCK. Similar to cod but smaller ; bronze-coloured with white belly ; large scales ; Apostle's thumb-mark on shoulder ; blackish spots above pectoral fins ; small barbel on chin ; well-defined black lateral line ; fins similar to coalfish.

HAKE. Long body ; broad flat head ; dark grey on back and silvery appearance on belly ; no barbel ; large scales ; large mouth and sharp teeth ; two dorsal, two pectoral, two ventral and one anal fins.

LING. Elongated fish ; long barbel on chin ; grey on back, white belly ; two dorsal fins, edges of which are tinged with grey ; first fin, high and short ; second, extremely long extending almost to tail ; minute scales ; eyes oval-shaped ; appears to be cross between conger eel and cod.

POLLACK. Much similar to coalfish but smaller ; dull green colour, belly dusky white.

WHITING. Smaller than haddock; head and body compressed; thickest part opposite middle of first dorsal fin; moderately large eyes; no barbel and does not show thumb marks as does haddock; black spot at base of pectoral fin; fins similar to coalfish and haddock; small scales; silvery, dusky yellow colour, sides pale, belly silvery-white; must be eaten when fresh as flesh rapidly deteriorates.

### Blenny Family

CATFISH. Bluish-grey colour; smooth skin; head similar to that of cat; long row of canine teeth behind which are double row of grinders; one species is spotted; normally beheaded and skinned before sale; skinned fish shows characteristic herring-bone markings; flesh pinkish in colour.

DOGFISH. Similar to catfish but shorter and thinner; flesh pinkish in colour; rough skin; sharp spines on dorsal fin; usually skinned for market.

### Mullet and Gurnard Family

GREY OR RED GURNARD. Head strongly armoured with bony plates; angular shape; spines along lateral lines and along base of dorsal fin; lowest three rays of breast fins separate and move independently; dark grey or red colour.

GREY MULLET. Round body; large, smooth round scales; silvery-grey in colour; two dorsal fins, front one composed of four spines; anal fin opposite second dorsal fin; no lateral line; poor teeth.

RED MULLET. Round body; large thin scales firmly attached to skin; bright red colour; two dorsal fins; front surface of head slopes down to flat undersurface; jaws and mouth in lower part; two stiff barbels; 6–8 inches in length.

### Mackerel Family

MACKEREL. One of best known fishes; highly esteemed for table; two dorsal fins behind which are five finlets; one anal fin also with five finlets; two pectoral, two ventral fins; caudal fin concave; eye has light yellow tinge; colour varies blue to green, darker on head; pearly white belly reflecting purple and crimson tints which pass off after death; obscure row of dusky spots; series of irregular wavy strips of dark colour pass from back downwards and obliquely forwards, ending above lateral line and usually stretch from pectoral fin to near tail. Belly turns pink if stale.

### Sea Bass Family

BASS. Head and body compressed; body not deep but muscular and strong; gill cover terminates in two blunt spines;

body and gill covers covered with scales ; moderate sized eyes ; lateral line descends lightly and then runs straight ; two dorsal fins in depression in back ; first has strong spinous rays of which first and sometimes second are short ; anal fin slightly behind second dorsal ; caudal fin concave ; bluish-grey on back shading lighter, silvery sides, white below.

SEA BREAM. Deep, plump body ; large scales ; red on back, silvery sides ; has thumb and finger mark ; one dorsal fin, front part of which is supported by strong spines ; hinder part has soft fin-rays.

### Herring Family

HERRING. Ventral fins behind commencement of dorsals which commence midway between tip of snout and base of tail ; thin, moderate sized scales ; edge of belly blunt ; no radiating lines on gill covers ; small, easily detached teeth in jaws, on roof of mouth and on tongue ; end of upper jaw beneath middle of eye ; greenish-blue on back shading to silver on belly.

PILCHARD OR SARDINE. Dorsal fin nearer snout than root of tail ; ventral fin behind commencement of dorsal ; teeth minute or absent ; radiating lines on bone beneath eye ; upper jaw reaches back to front of eye ; scales larger than others of this class ; easily detached ; belly edge rounded and spines weak ; body rounder than herring or sprat and not so deep ; deep olive green on back, sides silvery.

SHAD. Deeper in body than herring ; head and body compressed ; body covered with large scales to root of tail ; plate on top of head flat ; eyes moderate ; radiating branched lines on gill covers ; hooked serrations on line of belly ; dorsal fin over ventrals ; brown head, blue on back, light yellowy tints on gill covers and about upper parts of eye, sides with blue and pink tints, silvery below, black spot close behind upper border of gill covers.

SPRAT. Dorsal fin farther back than herring ; ventral fins slightly in front of commencement of dorsal ; moderate sized scales ; edge of belly sharp with strong spines ; no radiating lines on gill covers ; dark blue-black, shading to silver.

### Salmon Family

GRAYLING. Described under Fresh Water Varieties (see page 69).

SALMON. Inhabits both fresh and sea water ; described under Fresh Water Varieties (see page 69).

SALMON TROUT. Inhabits both fresh and salt water ; described under Fresh Water Varieties (see page 69).

SMELT. Small fish ; moderate sized scales ; light olive-green on back, silvery belly ; iridescent colours on sides ; broad silvery band along each side ; usually about 8 inches long.

### Sturgeon Family

STURGEON. Royal fish ; dorsal fin close to tail (35–40 rays), anal (23–25 rays), ventral (23 or 24 rays), pectoral fins very low and close to gills ; anal fin close to tail, beginning under where dorsal ends ; ventrals at tail end of body ; eleven to thirteen characteristic plates along back, twenty-three to twenty-six alongside ; those on abdomen vary in number and are less obvious ; mouth protractile and fleshy ; no teeth ; pronounced snout, half as long as head ; olive, greenish or yellowish in colour.

### Eel Family

CONGER EEL. Long, slender, flattening towards tail ; large gill openings ; dorsal fin commences close behind breast fin and continues into anal, round end of tail ; mouth wide ; upper jaw longer than lower ; dark coloured above, light or white underneath ; white spots mark openings of lateral lines ; dorsal fin edged with black.

EEL. Inhabits both fresh and salt water. Described under Fresh Water Varieties (see page 69).

## SALT WATER FLAT VARIETIES

### Flat Fish

ANGLER. Large head, flat, broad rather than long ; body short and tapering ; wide mouth ; upper jaw shorter than lower ; two rows of sharp teeth ; numerous filamentous rays over head ; one very long terminating in dermal flap ; smooth, brown skin with network of dark lines, lighter on belly.

BRILL. Differs from turbot in that it has smooth scales on upper surface ; no tubercles ; slightly narrower and longer than turbot in proportion to width ; has distinct curved lateral line ; eyes on left or dark side ; pectoral fin on blind side smaller than other ; colour on dead fish dark and uniform ; variable and speckled when alive ; underside white.

DAB. Like plaice in shape but smaller in size ; upper surface of body feels like sandpaper to touch due to spiny scales ; lateral line takes peculiar turn above pectoral fin ; eyes on right side and colour is light brown ; no spots on back.

FLOUNDER. Shaped like plaice but smaller ; has line of tubercles on spine ; no distinctive marks on dark side ;

sometimes nearly black, white side more brilliant than plaice.

HALIBUT. Body thick and narrow ; dorsal and anal fins rather narrow ; both end at some distance from tail ; eyes on right side ; smooth skin ; upper side olive-green or dark brown, white or sometimes mottled on under surface ; large mouth and teeth on both sides of jaws ; grows to enormous size.

JOHN DORY. Thin, deep, short body ; smooth skin, brownish in colour ; round black spot in centre surrounded by yellow ring ; long first dorsal fin, narrow second dorsal and anal fins ; large mouth ; when open, seems to protrude and form tube ; row of spines at base of dorsal fins on each side, those at base of second dorsal fin being double.

LEMON SOLE. Oval-shaped, small head and mouth ; skin smooth and slimy ; brown-orange in colour with light and dark patches or spots ; smooth scales extending all over body, on head and over fin-rays on upper side.

MEGRIM. Large mouth, head and eyes ; narrow, thin pale body ; small teeth on two sides in two rows ; eyes on left side ; dorsal fin commences in front of upper eye ; fin-rays more numerous than in brill ; light brown colour, no markings ; curved lateral line above pectoral fin somewhat oblong and not semi-circular ; skin thick with large and spinous scales, easily detached.

PLAICE. Oval in shape ; lower jaw larger than upper ; broad, flat teeth ending in straight edges ; round crushing teeth in throat ; scales small and embedded in skin ; eyes on right side, rough bony knobs on head ; dark brown upper surface with characteristic orange spots.

SKATE. Rhomboidal shape, rounded off in hind parts ; long, slender tail ; projecting snout ; slopes away at sides to extremity of expanded pectoral fin ; upper part dusky or grey ; mottled ; lower surface, white ; mouth situated here ; nostrils lobed and near angles of mouth ; five converging gill openings each side ; ventral fins broad and flat, enclosing vent. Several types, viz. :

(a) *Thornback.* Sharp snout and numerous large spiny tubercles on back.
(b) *Homelyn.* Short snout and small tubercles on back.
(c) *White Skate.* Very long, acutely pointed snout.
(d) *Common Skate.* Mottled grey back and short snout.

SOLE. Narrow oval-shaped body ; mouth underneath snout ; jaws curved ; outline of snout semi-circular ; dorsal fin commences on snout in front of eyes which are small ; no bones visible in head ; black spot at outer end of pectoral

fin on upper side; scaly skin extending equally over all parts; both pectoral fins of considerable size; nostrils on two sides similar; brown or greenish-brown on upper side; row of darker blotches along centre and along bases of fins.

TURBOT. Flesh yellowish-white; upper or darker coloured side has bony tubercles among scales; eyes on left or dark coloured side; distinguished from brill by greater length of body in proportion to length and by presence of tubercles. Under surface, yellowish white.

WITCH. Elongated body, oval in outline, thin and flat; smaller head than plaice and straight lateral line; upper side pale brown; smoky white on lower side; eyes large; dark skin, thinner than that of sole. Known as "pole dab."

## FRESH WATER VARIETIES

### *Salmon Family*

COMMON TROUT. Freshwater fish; back yellowish or reddish-brown; cheeks and sides grey or rich yellow, white below; gill covers and dorsal fin spotted; sides studded with dark spots; red spots along lateral line above and below; small scales.

GRAYLING. First dorsal fin high (20–24 rays), second rayless, anal (11–14 rays), caudal (21 rays), pectorals (15–16 rays), ventrals (10–11 rays); ventrals are under middle of dorsal; small anal is under second dorsal. Back more curved than abdomen; slender and graceful; upper jaw longer; head bluish, back golden; parallel grey lines along sides; fins banded and spotted with purple.

SALMON. Long round fish with ventral fins, abdominal opposite first dorsal and rayless fin opposite anal; bluish-black on back graduated to white under belly; covered with small bright scales; flesh deep red in colour: inhabits both fresh and salt water.

SALMON TROUT. Might be mistaken for salmon; smaller, shorter and bulkier towards tail; mouth longer in proportion; dark upper parts tinged with blue; tinge of pink on cheek alongside; whitish below, spots on gill covers; rather light ventral fins; smaller scales than salmon; flesh red; inhabits both fresh and salt water.

### Eel Family

EEL. Long, flexible body; dorsal, caudal and anal fins join to form one long fin which extends practically all round body; long lower jaw; lips fleshy; cheeks full; eyes small, opposite

end of mouth ; skin slimy and soft ; dark olive-green above and whitish or yellowish below.

### Characteristics

When *fresh*, eyes should be full and bright ; flesh firm, solid, opaque and elastic to touch ; when pressed with fingers should not pit or be gelatinous or watery ; should be full scaled ; gills clean and bright ; should possess no unpleasant smell. If not iced, should be fairly stiff ; flesh should not be easily separated from bone ; fresh fish will sink if placed in water ; abdominal cavity should be clean and not discoloured. In flat fish, skin should be smooth and adherent to flesh and unblistered. Girth rather than length is more desirable. Round fish keep their shape if fresh.

If *stale* reddish discolouration along backbone ; tainted smell ; flesh strips readily and easily from bones ; abdominal walls have red, soft, pulpy and jelly-like appearance with commencing discolouration and tainted odour ; eyes grey and sunken ; gills grey and slimy ; flesh pits on pressure ; if fish suspended by fin in middle of back, should balance ; extent of tail drooping shows degree of unsoundness ; stale fish float in water.

### Keeping Qualities

Varies ; surface fish (herring, mackerel) should be eaten as early as possible ; white fleshed fish (cod, etc.) keep fairly well ; flat fish keep best.

Keeping qualities depend on handling ; roughly handled, battered and bruised, carelessly packed and improperly gutted fish will not keep. Packing in dirty containers assists decomposition as does leaving attached to abdominal cavities parts of viscera when gutting. Newly-spawned or diseased fish readily decompose.

### Food Value

White fleshed fish is most nutritious and easily digested ; salmon and greasy fleshed fish more difficult to digest ; some persons cannot eat fish without showing symptoms of fish poisoning (purging, prostration, vomiting urticaria). Herrings and mackerel exert this effect on many people ; probably due to consumption of such fish in none too fresh condition.

### Close Seasons.

The following fish are not allowed to be sold between the dates given on p. 71 :

| | |
|---|---|
| Salmon . . . | Between August 31st and February 1st. |
| Fresh water trout . | Between August 31st and March 1st. |
| Oysters (native) . | Between May 14th and August 4th. |
| Oysters (deep sea) . | Between June 15th and August 4th. |
| Fresh water fish . | Between March 14th and June 16th. |
| Mussels . . . | Between May 1st and August 30th. |

There is no close season for salt water fish. All fish are usually in most perfect condition just before spawning; during this process they become flabby, thin and wasted; for some time afterwards can be said to be unfit for food and should not be used for this purpose. Edible crabs carrying spawn or soft shelled crabs are not allowed to be sold.

Fishes of the following sizes are regarded as immature:

| | |
|---|---|
| Hake . . . | If less than 13 inches in length. |
| Haddock and whiting | If less than 9½ inches in length. |
| Plaice, dabs, witches, lemon soles, megrims | If less than 9 inches in length. |
| Crabs . . . | If less than 4½ inches across broadest part of back. |
| Lobsters . . . | If less than 9 inches from tip of beak to end of tail. |

## *CURED VARIETIES*

Bloaters. Herrings rubbed with coarse salt to remove slime and scales; washed and soaked in brine for twelve hours; threaded by mouth and gills on sticks; allowed to drain and dried by air curing or over coke fire. To test, break and smell. If sound, are firm, dry and crisp; if stale, are dry and soft.

Smoked Haddock. Haddocks beheaded, gutted, split and washed, care being taken to remove black lining from stomach; pickled in brine for twenty to thirty minutes; hung and allowed to drain. Smoked for six to eight hours, softwood sawdust being used; peat is sometimes employed; fish takes on a light yellowish colour. To test for freshness, incise in thickest part of fish near bone and smell. This incision does not spoil market value of fish. Unsoundness denoted by stickiness along bone and offensive smell. Boxed smoked haddocks sometimes emit a disagreeable smell although sound.

Mackerel, sprats and pilchards are sometimes cured in a similar fashion.

Fillets. Haddocks, cod and other large fish beheaded, skinned, gutted, washed and scrubbed in clean water; cut into pieces and pickled in brine for half an hour; coloured

with annatto; dried and smoked. Yellow in colour. If unsound, are moist, soft and crumbly with stale odour.

KIPPERS. Herrings are split, offal removed and fish washed; pickled in brine for half an hour, then drained; smoked in kiln over smouldering wood chips; cooled. Sometimes smoked over coke fire and have bronzed appearance. Flesh normally soft and oily. To test for soundness, lift backbone and smell underneath. If not fresh when cured, soon become unsound and putrify.

RED HERRINGS. Not often seen now. Washed, gutted, then packed in salt in barrels until cured. Salting causes shrinkage, so fish are placed in clean cold water for one or two days in order they may regain their size. Drained; dried and afterwards smoked until required colour obtained, usually two to three weeks. Dry and firm and keep much longer than kippers.

All fish for curing should be perfectly fresh, properly cleansed and gutted and effectively cured.

### Inspection of Fish

Following points to be noted:

(*a*) Condition of eyes, scales and shape of fish.

(*b*) Gills firm and elastic; test with fingers if any doubt exists.

(*c*) Split fish and examine backbone for signs of decomposition. If bone is pink from end of tail towards head, condemn.

(*d*) Flat fish; tear down membrane in front of backbone; condition can then be ascertained.

(*e*) Test bone and blood with finger; no taint or smell on fingers if fresh.

(*f*) Abdominal cavity shows discolouration when flat fish are stale; split down lateral line and examine backbone.

(*g*) Putrefaction or decay chief cause of condemnation. Fish should be condemned for decay when rigor mortis has passed off; reddish-brown discolouration of back-bone, tainted or putrid smell; flesh strips cleanly from bone; abdominal walls have soft pulpy, jelly-like appearance and are discoloured or tainted; gills are grey and slimy or eyes sunken and grey.

## DISEASES OF FISH

### Bacterial

FISH POX. Nodular disease of fresh water fish; caused by *mxyosporidia*; located in muscles, skin and viscera; flesh *soft, yellow, gelatinous; bitter taste;* cause of "green disease" in cod, flesh stained green; affected fish should be condemned.

FURUNCULOSIS. Highly infectious; due to *Bacillus salmonicidæ*; affects salmon and fresh water fish with heavy mortality; organism is destroyed by salt water. Skin shows broken-down, suppurating tissue; may extend so that bones are exposed; soft swellings like boils; inflammation of intestines and small hæmorrhages on peritoneum and liver. If seen exposed for sale, such fish should be condemned.

SALMON DISEASE. Due to *Bacillus salmonis pestis*. Whitish patches on head and body; later deep, large ulcerations which gradually eat into flesh and kill fish. Rapid spread and heavy mortality; organism lives in either fresh or sea water, entering body through abrasion in skin. Disease can be conveyed from dead to living fish. Affected fish should be condemned.

TUBERCULOSIS. Lupus-like growth on skin near tail; contains cheesy matter. Found in cod and turbot. Soft yellow deposits in liver, stomach, intestines and abdomen. In advanced cases, mass of diseased tissue found in abdomen, eating into flesh and accompanied by ulceration of mouth.

## Diseases of Blood

CANCER. Swelling under jaw; gill rays affected with small nodules; may spread and affect all structures of head and neck when fish should be condemned.

TUMOURS. May be malignant or benign.

(*a*) *Sarcomata.* Malignant; coarse fibrous growth, emaciation ensues.

(*b*) *Osteomata.* Growth in radial bones; little effect on condition.

(*c*) *Epitheliomata.* Found on epidermal tissues; ulcerative condition due to pollution of water in estuaries, etc.; sometimes affects fresh water fish; malignant; fish become emaciated and die.

Large tumours are sometimes found in large halibut; may have soft centre and discharge pus; usually cause emaciation and render fish unfit for food.

## Moulds

SAPROLEGNIA. Affects salmon. Colourless growths which penetrate flesh; prevalent in fresh water only; spreads from fish to fish.

## Parasitic

BOTHRIOCEPHALUS LATUS. Cystic form of tapeworm found encysted in muscles of pike, halibut, turbot, eel, etc.

Cysts white with transparent surrounding tissue; conveyed to man through insufficiently cooked fish. Affected fish condemned.

Dokus acus. Affects haddocks; small cysts in flesh; odour of creosote when fish is incised. If heavily infested, fish should be condemned.

Echinorhyncus. Worm inhabiting intestines of salmon normally but one type found in trout and cod; small, reddish coloured; causes inflammation of intestines owing to penetration by hooklets on proboscis; may cause body sores. Normally confined to intestines which are not used for food so fish may be passed.

Epibdella. Flat worm parasite resembling box leaf in shape about size of finger nail; dull white in colour and usually found attached to skin. If skin removed, fish can normally be used for food. Halibut normally affected.

Filaria bicolor. Thread-like worm, 1½ inches long; usually found encysted in cod, coalfish, hake and pollack; young fish chiefly affected. No external sign of worms although present in large numbers. Do not affect consumer; cooking said to destroy parasite. Easily seen when fish is cut. Colour brown or light green; turns brown when cooking. Unpleasant in appearance and unmarketable when badly infested. Should be condemned if in that condition.

Fish Lice. Fix themselves by means of strong cables to the skin. Flounder chiefly affected.

Lernians. Live on gills or skin of fishes, causing emaciation when fish should be condemned.

Tænia tetrarhynchus. Found in cystic stage in whiting, haddock, cod, halibut and dog fish. Encysted embryos present attached to peritoneum and intestines and burrow into flesh. Harmless to man but when present in large numbers fish is unmarketable and should be condemned as such.

## Methods of Preservation

Refrigeration. Ice used to preserve fish at sea, in boxes and in shops. Some trawlers now employ refrigeration for this purpose. Fish should be gutted before refrigerated; large fish such as halibut often frozen hard. Salmon, imported from America frozen, often found to be discoloured yellow near skin and having rank taste; frozen fish when thawed usually dull and lacking in sheen, soft, flabby condition and small particles of ice seen in flesh.

Drying. Fish beheaded, opened flat, cleaned and soaked in brine for several hours; placed in wooden troughs with alternate layers of salt for several days; fish then turned

over and left again for several more days. When curing is finished, are dried in open air for a few days. Cured fish is dry and firm, yellowish in colour and thinly encrusted with salt. Cod, ling, hake, coalfish and haddock treated in this way. Only small amount consumed in this country ; mostly exported. Pink discolouration sometimes found ; due to micrococcus and organisms found in sea salt. Usually more prevalent during summer and if in this condition should be condemned. When unsound, dried fish is moist and crumbling with an offensive odour.

SMOKED. Fish are gutted, cleaned, sprinkled with salt and hung in kilns in which sawdust or wood chippings are allowed to smoulder ; coke is sometimes employed for this purpose. Uniform temperature is essential. Smoking imparts flavour and aroma, besides preserving fish. Smoking and drying prevent the entrance of putrefactive bacteria for a time. For varieties of smoked fish, see pages 71 and 72.

SALTING. Herrings often packed in salt for export. Are gutted, mixed with salt and packed into barrels, back downwards, as tightly as possible without injury to fish. Salt is sprinkled between each layer, and when fish have settled barrels are filled with salt brine and sealed for export.

PICKLING. Cod are cleansed and washed, placed in brine and pickled, afterwards being placed in barrels for export.

FRYING. Very popular throughout the country ; cheaper kinds are generally used ; fish cleansed, filleted and skinned, dipped in batter and fried in boiling fat. Sold with chipped potatoes and forming cheap, nourishing meal. Various types of fat employed, *i.e.*, lard, dripping, vegetable oils (peanut, linseed, cottonseed) or a mixture of these. May be unsound due to staleness of fish or sour batter. To examine, break batter and smell. Nuisances may arise from premises due to :

(*a*) Burning cooking medium at too high temperatures.

(*b*) Unsatisfactory cooking ranges which do not provide for consumption of fumes.

CANNING. Very popular foodstuff ; large quantities imported. Main varieties canned are :

(*a*) *Sardines.* Fish beheaded, entrails removed, placed in brine for an hour or two and afterwards trimmed and allowed to drain. Fish then graded, dried, placed on wire frames and lowered into olive oil and allowed to cook. When cooking is completed, fish rise to surface, are removed and allowed to drain or are dried in special chambers. Sardines sometimes cooked by steaming process. The fish are then placed in cans, covered with olive oil, or packed in tomato purée or cheaper forms of oil according to grade. Tins then capped and sealed airtight. Being packed hot they do not

need exhaustion. Then processed in boiling water. Herrings and pilchards are canned in a similar manner.

(*b*) *Salmon*. Fish cleaned of blood and scales ; beheaded and viscera removed ; passed into cutting machine which trims off cutlets of required sizes. Cans filled and passed to steam exhaust box for five minutes. Covers placed on cans while still hot so that vacuum results after cooling. Processed for one and a half hours at 240° F. Cans then dipped in shellac, dried, labelled and packed.

(*c*) *Crab*. Boiled and then cooled in salt water ; shells cracked and flesh removed ; placed in cans lined with parchment paper. Cans exhausted and processed in boiling water. Lobster, prawns, crayfish and shrimps are canned in a similar manner.

OTHER METHODS. Many other methods of fish preservation, principal of which are :

(*a*) *Potting*. Shrimps are usually packed in this manner in this country. Boiled and skins peeled off ; seasoned with salt and pepper, etc. ; filled into pots and heated to sterilise. When cooled, covered with layer of melted butter or fat to protect them from air. Smell is chief guide to unsoundness. Fat on surface may crack allowing air to enter or may become rancid.

Shrimps and prawns are also packed in glass jars.

(*b*) *Fish Paste*. Manufactured from shrimps, anchovies, lobster, salmon, bloater and kipper or combinations of these. Fish is cooked, mixed with edible fat, seasoned, flavoured and packed into glass jars which are sealed and sterilised.

## SHELLFISH

### General

Two classes of shellfish, viz. :

(*a*) *Mulluscs*. Have soft body protected by shell. (Oysters, mussels, cockles.)

(*b*) *Crustaceans*. Body encased with hard shell ; flesh firmer than that of mollusc. (Lobster, crab, prawn.)

### Molluscs

COCKLES. Heart shaped ; ribbed shells of equal thickness ; found in estuaries and sandy bays ; have foot which assists them to burrow into sandy bottom ; never out of season but better in latter half of year ; boiled before use. If sound and fresh are usually closed and difficult to open. If open, smart tap will cause shell to close if fish is alive. Bad smell, dull colour and gaping shell, together with hollow ring, denotes unsoundness.

ESCALLOP. Possesses two ribbed, fan-shaped shells ; hinge at narrow end ; one shell more arched than other ; shells brownish-pink externally and pearly white shading to pink inside ; 4–5 inches across. Flesh white with orange attachment partially encircling it. Found in deep water so not so liable to contamination as other shellfish ; in season at all times but best in cold weather. Shells may gape when fish is alive ; if beard surrounding body is touched, fish will move if fresh. Staleness and decomposition can readily be detected by smelling. Cooked before use.

MUSSELS. Bivalves ; 2½–3 inches in length ; soft red or yellowish-red body enclosed in two oval shells (blue-black outside and glistening white inside). Found at sea bottom in clusters on rocks and in estuaries. For close season, see page 71. At best in autumn. Very prone to sewage pollution but in clean water can cleanse themselves in a few days. If sound and fresh, usually closed and difficult to open. Stale or dead mussels gape, ring hollowly when unsound, are dull in colour and smell offensive. Boiled before use.

OYSTERS. Found in sandy beds in estuaries and on rocks near shore. Creamy-white body enclosed in two hard shells held together by strong muscle. Native oysters are thin shelled and smaller. Deep sea oysters are large and have rough, thick shells. Oysters take several years to mature ; natives are best when four to six years old. When fresh, shells tightly closed, and if open, should immediately close when tapped. Unsoundness denoted by offensive smell, gaping shells which do not close when tapped and have hollow ring. Slightly open shells denote loss of freshness. Floated oysters are those adulterated by packing with ice. Oysters with gaping shells are unfit for food. See page 71 for close season. Disease is rare but oysters are liable to pollution or contamination by impure water ; can cleanse themselves in ten to 14 days. Generally eaten uncooked.

PERIWINKLES. Single whorled shell like snail ; circular opening through which foot assists movement ; found around coasts ; seasonable throughout year but in better condition in colder months. If sound, foot is prominent and not shrunken ; should not break when removed with pin from shell. A handful should be tested for smell. Whole bag should be condemned if any found stale. Boiled before use.

WHELKS. Single shelled ; shells like snails ; whorled and ridged ending in point ; opening is large and foot protrudes ; best in spring although in season throughout year. Very clammy when decomposing ; on being removed from shell in this state smells offensively. Boiled before use.

## Crustaceans

CRABS. Greenish in colour, turn reddish-brown when boiled. Male denoted by small apron (armour-plated flap on underside between legs) and large claws. Female, *vice versa.* Minimum size allowed on market is 4½ inches across broadest part of back. Unsoundness denoted by smell under apron, joints of claws and limpness of body. Faded appearance indicates staleness. Lightweight crabs should be condemned. Should not be wet and sticky under large claws. Head and thorax united to form short, squat body enclosed in hard shell; abdomen curved under thorax; large claws and four pairs of legs; shell is cast from time to time; when without shell, is known as "soft-shell"; illegal to sell in this condition. Killed by piercing between eyes, otherwise claws are cast. In season all year round but best between April and July.

CRAYFISH. Miniature lobster but inhabits fresh water; longer antennæ and claws more equal in size. Greyish in colour when alive; red after boiling.

LOBSTER. Long-tailed, many-jointed body; ten legs, two of which form claws or pincers which are unequal in size; fan-shaped tail. Hard shell, blue-black in colour when alive, red when boiled. Male recognised by strong swimlets (first pair of feelers at junction of tail and body) and narrow back. Minimum length to be 9 inches from head to tail. Best during summer months; cannot be sold in soft state when casting shell. Unsoundness denoted by behaviour of tail. When this is pulled back, if lobster is fresh it should quickly resume its original position. Should not be wet and sticky under large claws. Examine under tail for discolouration.

PRAWNS. Are single-coloured. Have long, serrated-edged sword projecting from snout; tails should be turned inwards and stiff. Clear prominent eyes, feel crisp and have a pleasant smell. When soft, heated or sticky, are unsound. Like small lobsters; small pincers; greyish in colour when alive; bright red and semi-transparent when boiled. About 3 inches in length. Best condition during summer months. Generally boiled before being sent to market.

SHRIMPS. Smaller than prawns; do not possess any horns. Pink shrimp has alternate red and white rings on feelers; also brown type of shrimp. Pink variety found in deep water; brown type in estuaries on sandy beds. Boiled in salt water becoming brownish pink. In season throughout the year. When stale emit an ammoniacal odour which is most objectionable. Inspection same as for prawns.

## Diseases caused by Shellfish

Molluscs chief cause of disease; should be obtained from

clean layings or beds unpolluted by sewage; outbreaks of enteric fever have occurred from time to time due to the consumption of infected oysters, cockles and mussels. Imported mussels sometimes give rise to a form of nettlerash poisoning on affected person accompanied by intense itching, vomiting or diarrhœa; illness is of short duration and rarely fatal. Similar form of illness may occur to susceptible persons following consumption of crabs and lobsters. Due to properties inherent in shellfish. A form of bacterial food poisoning may occur after consumption of polluted shellfish.

# MILK AND MILK PRODUCTS

## MILK

### Definition

Milk is an amphoteric liquid and is the food designed by nature for feeding the young from birth until weaned.

### General

Milk is the product of lacteal glands of cow after calving; cows yield for ten to twelve months; average yield per cow in good condition is approximately 2–3 gallons per day.

Good milk is yellowish white in colour; opaque liquid having fresh smell and bland, sweet taste; cream rises to surface if allowed to stand for four to eight hours; remainder of milk less opaque and whitish or bluish in colour. In milking, first portion termed "foremilk" and is bacteriologically poor; second portion, termed "middle milk," is of fair quality; third portion, known as "strippings," and is very rich in fat.

Proportion of fat varies throughout year by as much as 0·5 per cent. Lowest in fat content but greatest in quantity in April to June. The fact that animals are turned out to grass in spring often urged in defence of poor quality but has little or no effect on milk if suitable concentrated foods are given. Weather conditions do not affect quantity or quality.

Most useful breeds for dairy purposes are Shorthorn, Welsh, Friesian, Ayrshire, Kerry, and Channel Islands cattle.

### Chemical Characteristics

AVERAGE COMPOSITION:

| | | |
|---|---|---|
| Water . . . . . . | 87·20 | per cent. |
| Fat (stearin, olein, etc.) . . | 3·90 | ,, |
| Milk sugar (lactose) . . . | 4·75 | ,, |
| Nitrogenous compounds (casein, albumin) . . . . . | 3·40 | ,, |
| Mineral ash (calcium, potash phosphates). . . . | 0·75 | ,, |
| | 100·00 | ,, |

ENZYMES are: Lipase, phosphatase, amylase, galactase, catalase, peridoxase, reductase.

VITAMINS are :

| | |
|---|---|
| A . . | Heat resistant. |
| $B_1$ . . | Anti-neuritic ; heat resistant. |
| $B_2$ . . | Anti-dermatitis ; heat resistant. |
| C . . | Anti-scorbutic ; sensitive to heat and oxidation. |
| D . . | Anti-rachitic and calcifying ; can be increased by irradiation. |
| E . . | Reproductive vitamin. |

VARIATIONS IN COMPOSITION due to :

(*a*) *Breed of cow.* Milk from heavy yielders has usually low fat content and *vice versa.*
(*b*) *Feeding.* Common cause of low yields.
(*c*) *Season of Year.* Winter milk richest in fat, summer greatest in quantity.
(*d*) *Age of Animal.* Heaviest milkers between four to seven years ; average useful life of cow is four and a half years.
(*e*) *Health of Animal.* Ailing animals give reduced supplies.
(*f*) *Efficiency of Milker.* Inefficient milking and failure to strip udder at each milking causes animals to dry off early.
(*g*) *Interval between Milking.* Equal intervals to be preferred ; morning milk greatest in quantity but lowest in fat ; variation as much as 0·3 per cent. has been found.
(*h*) *Period of Lactation.* Too frequent lactations should be avoided and adequate rest given between each.
(*i*) *Individuality of Cow.* Variations in fat up to 1 per cent. have been observed in different animals.

CELLULAR CONTENT is :

(*a*) Polymorphonuclear cells.
(*b*) Large cells, varying in size.
(*c*) Lymphocytes, varying in size.

HIGH CELL COUNTS found in milk from :

(*a*) Cows just after calving.
(*b*) Cows in later stages of pregnancy.
(*c*) Cows drying off.
(*d*) Cows having diseased udders (tuberculosis, mastitis).

## Bacteria in Milk

Two groups, viz. :

(*a*) Pathogenic.
(*b*) Non-pathogenic.

Milk as it leaves udder practically sterile and bacterial content increases on account of pollution from variety of sources. Bacteria do not multiply quickly at temperatures below 50° F.

PATHOGENIC ORGANISMS OF ANIMAL DISEASE which may be present :

(*a*) *Bacillus tuberculosis*—tuberculosis.
(*b*) *Brucella abortus*—contagious abortion, undulant fever.
(*c*) *Streptococcus mastitidis*
(*d*) *Bacillus pyogenes* } Mastitis, hæmolytic streptococci, epidemic sore throat, scarlet fever.
(*e*) *Bacillus anthracis*—anthrax.
(*f*) *Viruses of cow pox and foot and mouth disease.*
(*g*) *Actinomycoses*—wooden tongue, lumpy jaw.
(*h*) *Bacillus enteritidis of Gaertner*—digestive affections, food poisoning.

PATHOGENIC ORGANISMS OF HUMAN DISEASE are :

(*a*) Typhoid and paratyphoid.
(*b*) Dysentery.
(*c*) Diphtheria.
(*d*) Scarlet fever and septic throat.
(*e*) Tuberculosis.

Cleanliness of milk is no guarantee of freedom from pathogenic organisms.

NON-PATHOGENIC ORGANISMS are :

(*a*) Souring organisms—*Streptococcus lactis* and *staphylococci* ; change lactose into lactic acid, milk curdles and curd separates into flocculent mass.
(*b*) Intestinal organisms—*Bacillus coli* and *Bacillus aerogenes*
(*c*) Saphrophytic organisms—causing putrefaction.
(*d*) Spore-formers—*Bacillus protei*, *putrificus* and *Welchii.*
(*e*) Chromogenic organisms—*Bacillus prodigiosus*, *cyanogenes* and *fluorescens.*

SOURCES OF BACTERIAL INFECTION are animal itself, persons handling animal and utensils, infected water, air of cowshed and dairy, fly infection and infection in consumer's home.

THERMAL DEATH POINTS of pathogenic organisms are :

| | | |
|---|---|---|
| *B. tuberculosis* . . | 140° F. | for 20 minutes. |
| *Br. abortus* . . . | ,, | ,, 15 ,, |
| *B. typhosus* and *paratyphosus* | ,, | ,, 5 ,, |
| *C. diphtheriæ* . . . | ,, | ,, 3 ,, |
| *B. dysenteriæ* . . . | ,, | ,, 10 ,, |
| *Streptococci* . . . | 130°–145° F. | ,, 5 ,, |

### Diseases carried by Milk

ANIMAL ORIGIN are tuberculosis (common), contagious abortion (probably common; not long recognised as milk-borne), foot and mouth disease and anthrax (uncommon), mastitis (may cause septic throat) and digestive affections (cause of food poisoning).

HUMAN ORIGIN are typhoid and paratyphoid, dysentery, diphtheria, scarlet fever (most common).

CHARACTERISTICS OF MILK-BORNE EPIDEMIC are:

(*a*) Explosive in character.

(*b*) Large number of affected persons have same source of supply.

(*c*) Incidence higher in better-class families who consume more milk.

(*d*) Incubation period of disease may be shortened.

(*e*) Women and children—heavy milk drinkers—mostly affected.

(*f*) Chiefly occur in smaller towns and rural districts where milk is unpasteurised.

(*g*) When infected supply stopped, outbreak subsides.

### Abnormalities in Milk

ROPINESS—feeding; water supply; sometimes immediately after calving.

COLOURATION—blue, yellow or red; bacterial cause; chromogenic organisms.

SOAPINESS—fodder and straw.

BITTERNESS—feeding stuffs.

TALLOWINESS—oxidation; sunlight.

OILINESS—defects in utensils.

Milk quickly absorbs taints from strong-smelling articles such as paraffin, fish, disinfectants.

"Beastings" or "colostrum" is milk from newly-calved animal; should not be mixed with other milk until 14 days have elapsed after calving.

### Sediment

Should not exceed 10 parts per 100,000. Sediment tester used; cylindrical instrument holding 1 pint milk which is forced through nozzle over which is fitted gauze disc and pad of sterile cotton wool. Impurities filtered out and wool discs examined under low power lens.

### Cowshed

Important points to note are:

(*a*) SITE AND ASPECT—conditions similar to dwelling

house ; easy access to site ; double range building N. to S. ; single range, E. to W.

(*b*) SIZE AND PLANNING—depends upon type of building, method of fastening cattle, type and number of animals, and space available.

(*c*) CUBIC SPACE AND VENTILATION—if stalled during winter, 700–800 cubic feet per cow, according to breed ; windows to open and ventilators in addition.

(*d*) LIGHTING—adequate natural and artificial light, essential.

(*e*) CONSTRUCTION AND FITTINGS—of best materials ; water bowls and feeding troughs essential.

(*f*) WATER SUPPLY AND DRAINAGE—adequate water supply essential ; adequate drainage outside building.

On inspection cowshed should possess no offensive odour, appear light and airy, and there should be no food scraps in feeding trough. Animals should have healthy contented appearance.

### Dairy

Structural conditions similar to cowshed. Milk receiving room and washing rooms should be separate. Steam should be provided for sterilisation. Milk should be bottled.

### Clean Milk Production

Clean milk can be produced by any person having will to succeed and having fixed determination to continually carry out necessary steps.

Clean milk is milk of low bacterial count, free of pathogenic organisms and possessing good keeping quality. Points to remember are :—

(*a*) Cleansing of animals.
(*b*) Cleansing of cowsheds and dairies.
(*c*) Protection of milk from contamination.
(*d*) Rejection of foremilk.
(*e*) Dry milking.
(*f*) Immediate removal of milk from cowshed.
(*g*) Immediate cooling.
(*h*) Clean personnel.
(*i*) Bottled after cooling.
(*j*) Care of milk in consumer's home.

### Designated Milk

TUBERCULIN TESTED (CERTIFIED) AND TUBERCULIN TESTED.

(*a*) Animals tuberculin tested every six months and reactors removed from herd.

(*b*) Animals clinically examined every three months.

(*c*) T.T. (Cert.) to be bottled at farm. T.T. bottled by distributor and must be forwarded in sealed churn.

(*d*) Labelled with day and time of production.

(*e*) Must satisfy methylene blue test.

(*f*) No coliform organisms to be present in 1/100th ml.

TUBERCULIN TESTED (PASTEURISED). As T.T. but bacterial content must not be more than 30,000 organisms per millilitre.

ACCREDITED. (*a*) Animals clinically examined every three months and ailing animals removed from herd.

(*b*) Labelled with day and time of production.

(*c*) Must satisfy methylene blue test.

(*d*) Coliform organisms not to he present in 1/100th ml.

PASTEURISED. (*a*) Shall be retained at a temperature of 145°–150° F. for thirty minutes (holder process) or at 162° F. for fifteen seconds (high-temperature, short-time process). Immediately cooled to not more than 55° F.

(*b*) Heated once only.

(*c*) Suitable temperature recorders and control arrangements to be provided.

(*d*) To be labelled " Pasteurised."

(*e*) Shall not contain more than 100,000 bacteria per ml.

## Milk Processing

Several processing methods employed ; these are pasteurisation, homogenisation, sterilisation, irradiation, stassanisation.

## Pasteurisation

(1) FLASH. Milk heated to temperature of 160°–170° F. ; then immediately cooled ; employed mainly to reduce bacterial content and improve keeping quality ; milk often overheated, cream-line damaged and chemical composition altered ; no guarantee of destruction of pathogens.

(2) CONTINUOUS FLOW. Improvement on flash pasteurisation ; milk flow arranged so it is retained at 145°–150° F. for the thirty minutes required to pass through apparatus. Not satisfactory ; holding period cannot be guaranteed nor can destruction of pathogens ; keeping quality improved by reduction of bacterial content. Faulty design may prevent all milk being held for requisite period ; some may escape adequate heating.

(3) HOLDER. May be carried out either by " Batch " method or by Tank system.

(*a*) *Batch Method.* Suitable for small distributor ; independent tanks holding 100 gallons each ; heating by

steam or hot water ; agitation provided ; milk often preheated separately prior to holding but can be preheated or cooled in holder ; this is not advisable ; cooling should be carried out separately ; care taken to ensure that no milk is held outside heated jacket ; filled and discharged by hand or automatically ; temperature recorders essential ; may be coupled to give continuous processing ; complies with official requirements.

(*b*) *Tank System.* Used by large diaries ; milk weighed, pumped to storage vats. Several large tanks coupled giving continuous working. Agitation essential but foaming to be avoided as foam is at reduced temperature ; milk preheated, held and cooled. Regeneration often employed ; heated outgoing milk gives preliminary heating to incoming cold milk. Heat exchangers employed designed to heat and cool in one apparatus ; usually of plate or tubular type. Tarbet holder has six compartments ; revolves, gives complete continuity. Tanks often hold 1,000 gallons ; insulated against heat loss and efficient temperature controls are essential. In large plants, vacuum and compressed air system used ; milk drawn through plant into holder by vacuum ; in holder is atmospheric pressure ; discharged by compressed air through cooler. Complies with official requirements.

(4) In-bottle. Milk at 146°–147° F. filled into hot bottles ; sealed ; passed through heated chamber ; retained at 146°–147° F. ; takes thirty minutes to pass through. Immersed in water at varying temperatures until cooled. No danger of contamination after treatment. Efficient temperature controls essential. Complies with official requirements.

(5) High-temperature, Short-time. Recently allowed by Provisional Regulations, 1941. Held at 162° F. for fifteen seconds ; various types, plate, tubular, electric. Advantages are economy of space and fuel. Sub-temperature milk returned for further processing by flow-diversion valve ; most important part of apparatus ; controlled by milk temperature ; if temperature falls, valve opens and diverts flow of milk. Efficient temperature controls essential. Complies with official requirements.

## Homogenisation

Process emulsifies fat globules ; uniform distribution of fat throughout milk results, giving greater apparent creami-

ness ; fat cannot return to normal state. Milk previously heated forced through small valve ; subjected to pressure of 2,000–2,500 lbs. per sq. inch ; fat globules broken up into minute particles due to passage from high to low pressure region ; milk cannot be skimmed of fat.

**Sterilisation**

Milk filtered, homogenised ; heated milk filled into hot bottles ; travels through heated chamber or heated by boiling water or steam ; temperature 212°–220° F. ; sealed on leaving ; finally cooled. No cream-line ; popular demand in large towns.

**Irradiation**

Milk subjected to short-wave rays of mercury vapour lamp ; vitamin D content improved ; not popular at present in this country ; raw or processed milk can be treated ; bacterial content much reduced.

**Stassanisation**

Treated by processes devised by Dr. Stassano ; heated in water-jacketted drums, passing through in extremely thin film at 165° F. for fifteen seconds ; not much used in this country. Not officially recognised but is said to give satisfactory product and be economical in use.

**Inspection of Plant**

Points to note are :

(1) BUILDINGS. Floor and air space, ventilation, lighting, freedom from dust and effluvia ; condition of walls, floors, roof ; general cleanliness.

(2) LAYOUT. Economy of space ; no overcrowding ; room for expansion, operation and cleansing ; temperature recorders in good light.

(3) PLANT. (*a*) *Tipping Tanks.* Protection from dust and oil ; cleanliness.

(*b*) *Pumps.* Cleanliness ; no frothing.

(*c*) *Heaters.* Cleanliness ; complete separation of milk from hot water or pasteurised milk ; suitable temperature control.

(*d*) *Filters.* Cleanliness of filters and cloths ; no excessive filtration pressure.

(*e*) *Holders.* Cleanliness ; good insulation ; no foaming ; protection of milk ; efficient valves ; accuracy of valve timing ; no overflow from compartment to compartment ; sufficient temperature controls ; milk maintained at correct temperature.

(*f*) *Cooler.* Cleanliness ; protection from dust ; complete separation of milk from cooling media.
(*g*) *Pipe-lines.* Cleanliness ; separate lines for raw and processed milk.
(*h*) *Storage Tanks.* Cleanliness of tanks and agitating gear ; separate tanks for raw and processed milk.
(*i*) *Bottling Machines.* Cleanliness ; no drips from valves ; milk reservoir covered.
(*j*) *Bottle Washing Machines.* Cleanliness of jets ; temperatures maintained ; strength of detergent.
(*k*) *Utensils and Bottles.* Cleanliness ; clean storage after sterilisation.

## Laboratory Control

Milk should be sampled for bacteriological and chemical examination at frequent intervals.

BACTERIOLOGICAL TESTS. (*a*) *Plate Count.* Given quantity of diluted milk mixed with nutrient agar media in Petri dish ; incubated for forty-eight hours at 37° C. ; number of colonies counted.

(*b*) *Microscopic Count.* 0·1 ml. milk spread over 1 sq. cm. on glass slide ; material fixed, fat removed, slide stained with Newman's stain ; examined under microscope.

(*c*) *Microscopic Colony Count.* 0·25 ml. milk mixed with 0·25 ml. agar on sterile glass slide ; spread over area 4 sq. cm. ; incubated in moist chamber at 37° C. for eight to sixteen hours ; dried, fixed and stained with ¼-strength methylene blue ; colonies counted.

(*d*) *Breed Smear.* Modification of plate method ; slopes used instead of dishes ; standardised platinum loop holding 0·001 ml. of milk used ; 5 loopfuls of sample smeared over slope ; incubated at 37° F. for forty-eight hours ; colonies on agar slope counted by means of lens.

(*e*) *Coliform Estimation.* Several tubes each containing an inverted Durham's tube with 10 ml. bile salt, lactose-peptine media (liquid) inoculated with various dilutions of milk ; incubated forty-eight hours at 37° C. ; acid production changes neutral litmus to bright pink ; gas forms in Durham's tube.

(*f*) *Tubercle Bacilli.* Guinea-pig inoculation only sure method ; time taken is about six weeks ; great disadvantage.

CHEMICAL TESTS. (*a*) *Reductase Test.* 1 ml. methylene-blue solution added to 10 ml. milk. Tube stoppered and incubated in water-bath at 37° C. Good quality milk not decolourised in less than four and a half hours in summer or five hours in winter.

(*b*) *Resazurin Test.* Used in National Milk Testing Scheme.

1 ml. standard Resazurin solution added to 10 ml. milk. Tube stoppered; incubated in water-bath for one hour at 37° C. Colour changes from mauvish-blue (top grade) through pink to white (rejected). Seven grades of colour, last four denoting unsatisfactory supplies.

(c) *Phosphatase Test.* 10·0 ml. buffer substrate solution mixed with 0·5 ml. milk; incubated twenty-four hours at 37° C.; 4·5 ml. dilute special test reagent added and mixture filtered; to filtrate 2 ml. of 14 per cent. solution sodium carbonate added and tube placed in boiling water for two minutes and mixture poured into standard cell. Placed in comparator and compared with colour discs. More than 2·3 units of blue denotes errors in or inefficient pasteurisation.

### Adulteration of Milk

Adulteration illegal; water main adulterant although cane sugar, glycerine, carbonate of soda, salt, starch, borax, boracic acid and salycylic acid have been used for adulteration.

Milk presumed not to be genuine if containing less than 3 per cent. fat or less than 8·5 per cent. non-fatty solids. Added water discovered by freezing point test.

## MILK PRODUCTS

### Butter

Composition (see page 96). Colour varies from white to deep yellow; annatto sometimes added to colour; keeping quality depends on salt and casein content; sometimes found adulterated by foreign fats such as margarine or by excessive water content. High food value; manufactured from cream separated from milk, pasteurised, ripened, churned; butter produced washed, salted and worked to remove moisture. May be contaminated by raw materials, salt, packing materials, water supply, utensils or personnel. Chief faults are:

(a) *Sourness.* Due to excessive rancidity.

(b) *Bitterness.* Due to feeding stuffs or ripening cream at too low a temperature.

(c) *Food Taints.* Due to excess of certain foods in animal rations such as roots, silage and highly flavoured concentrates.

(d) *Staleness.* Found in hot weather; due to poor quality cream; over-lengthy storage.

(e) *Rancidity.* Final stage of staleness; closely allied to moulds; shows advanced deterioration of product.

(f) *Insipid Taste.* Caused by insufficiently ripened cream; over-washing of butter.

(g) *Talloweiness.* Presence of copper salts in cream; over-

ripening of cream ; feeding materials ; exposure of cream to sunlight.

Butter *sold in this* country normally blended ; contains bacteria, particularly lactic-acid type ; may contain pathogenic organisms present in original cream or which have obtained entrance from infected personnel. No standard of fat percentage ; moisture content limited to 16 per cent.

### Butter Milk

By-product of butter making ; more easily digested than cow's milk as casein finely divided ; little used as article of diet ; usually fed to pigs or may be converted into butter-milk cheese ; possesses valuable remedial properties. Composition, see page 96.

### Cheese

High food value ; large quantities imported. Various types :

(*a*) HARD CHEESES. Cheddar, Cheshire, Gloucester, Gruyère, Swiss.

(*b*) BLUE VEINED. Stilton, Gorgonzola, Rocquefort.

(*c*) SOFT. Bondon, Camembert, Limburger.

(*d*) SPECIAL. Cream cheese, Crustless cheese.

Composition, see page 96. Manufacture varies according to type. Milk ripened, rennet added ; milk curdles ; curd cut ; cheese is pressed and wrapped. Allowed to ripen before use.

Crustless cheese manufactured from variety of cheeses ; blended, melted at 140° F. and moulded into various shapes. Portions cut and wrapped or sold in large blocks. Normally wrapped in tinfoil ; should receive primary wrapping of tissue-paper to prevent metallic contamination. Cheese is liable to abnormalities arising from :

(*a*) ABNORMAL RAW MILK. Containing colostrum ; gas producing organisms ; animals with digestive disorders ; fermenting yeasts ; defects in taste and smell due to feeding stuffs ; bitter ; tallowy.

(*b*) FAULTS IN MANUFACTURE. Too acid curd, over-drying ; kept in damp state will liquefy ; colour defects due to manufacture and chromogenic organisms ; rust ; red mould ; yellow colouration ; over-acid ; over-salting ; over-cooking.

(*c*) BACTERIAL ACTION. Colour defects ; cheese mites or cheese flies cause crumbling and waste ; moulds.

Cheese *contains many non-pathogenic* organisms most of which are useful in manufacture. May contain pathogens from original milk. Cheese has been cause of many outbreaks of food poisoning.

## Cream

Very important product—high food value; milk fat removed by centrifugal separation or settling and skimming; quantity obtained depends on quality and composition of milk; may contain either pathogenic or non-pathogenic organisms as original milk; outbreaks of enteric fever have been traced to cream; various types with varying compositions (average composition, see page 96). Coffee or fruit cream, medium, thick, or clotted cream. Cream often homogenised to improve palatability and increase viscosity; should be pasteurised before sale. Addition of preservatives illegal.

CLOTTED CREAM. Produced chiefly in Devon and Cornwall; cream allowed to rise on milk; scalded with steam and clots; removed from surface of milk. Thick and butter-like.

ARTIFICIAL CREAM. Much used by confectioners; reconstituted from unsalted butter, skimmed milk powder and water by means of emulsifier.

TINNED CREAM. Large quantities produced abroad sold annually; has peculiar cooked taste; fat content usually about 20–30 per cent.; is homogenised, filled in cans which are exhausted, sealed, sterilised at high temperature.

## Condensed Milk

Convenient product for household use; good keeping qualities; can be reconstituted into equivalent milk plus sugar by addition of water; condensed whole milk used for infant feeding but not skimmed variety. Two types, viz.:

(*a*) Sweetened whole milk
(*b*) Sweetened skimmed milk } Composition, see page 96.

Milk pasteurised, sugar added, condensed in vacuum under reduced pressure or by dry air; drawn off, cooled, filled into cans or barrels. Cans exhausted, sealed, sterilised and ready for sale. May contain many types of non-pathogenic organisms; also bacillus tuberculosis has been found in this type of milk. Defects are:

BACTERIAL. (*a*) *Gassy Fermentation.* Due to gas-producing organisms and yeasts; from milk, plant employed, sugar, particularly invert sugar.

(*b*) *Bacterial Thickening.* Due to organisms, particularly cocci; low temperature storage or high sugar content will inhibit.

(*c*) *Buttons.* Due to mould; occurs after storage; reddish-brown pieces of curd; low temperature storage prevents.

NON-BACTERIAL. (*a*) *Grittiness.* Due to lactose crystals caused by faulty cooling; rapid initial cooling essential so that minute sugar crystals are formed.

(*b*) *Thickening.* Due to changes in colloidal constitution of albumen and casein ; storage below 60° F. prevents ; pre-heating at too high temperature and degree of concentration affects thickening.

(*c*) *Lumpiness.* Soft, floating, cheesy lumps ; due to high albumin and globulin content of milk and use of acid flux for sealing cans.

(*d*) *Rancidity.* Renders product unfit for consumption ; causes are high lipase content of milk, contamination with bacteria, yeasts and moulds which secrete lipase ; efficient pasteurisation prevents.

(*e*) *Brown Colouration.* Milk becomes dark brown during storage ; due to formation of humus by interaction of sucrose, lactose and milk proteins ; storage at low temperature prevents.

Conditions of sale are :

| | *Fat.* | *Total Solids including Fat.* |
|---|---|---|
| Full cream sweetened . | 9 per cent. | 31 per cent. |
| Skimmed sweetened . | | 26 per cent. |

Must be labelled either "Full Cream Sweetened" or "Skimmed Sweetened." When skimmed, must be further labelled "Unfit for Babies."

## Dried Milk

No standard composition ; average composition, see page 96. Legal standard of fat content :

| | |
|---|---|
| Whole milk powder . . | 26·0 per cent. |
| Skimmed milk powder. . | Less than 8 per cent. |

Whole milk powder has high food value ; used for infant feeding ; sugar content may be artificially increased ; can be reconstituted into liquid milk by addition of water ; used in manufacture of biscuits, ice cream ; in tropics and at sea ; can be stored for lengthy periods without deterioration. Skimmed milk powder normally used for manufacturing purposes. Two methods of preparation, viz. :—

(*a*) Roller Drying. Milk preconcentrated ; fed on to heated rollers ; removed in dry condition in sheet form ; sifted, blended, weighed, packed : may be roller dried under vacuum which increases rate of evaporation and allows employment of lower temperatures. Band driers also used ; milk spread on endless band enclosed in heated chamber in which vacuum is maintained.

(*b*) Spray Drying. Preconcentrated ; sprayed by

atomiser into heated chamber ; falls to floor in form of powder.

Roller dried powder rather darker than spray dried ; with roller dried powder, rennet coagulates irregularly. Properties of dried milk affected by temperatures of precondensing and drying.

Requirements of good powder are :

(*a*) Solubility. Spray dried almost 100 per cent. ; roller dried 83 per cent.

(*b*) Keeping Quality. Roller dried powder possesses better keeping qualities.

(*c*) Nutritive Value. Depends on whether skimmed or unskimmed ; roller dried powder reconstitutes better.

Defects found are :

(*a*) Tallowiness. Due to oxidation of fat.

(*b*) Rancidity. Due to development of lipase which has not been destroyed in processing.

Contains very few organisms of any type ; pathogenic bacteria most uncommon. Must be labelled "Dried Full Cream" or "Dried Skimmed Milk (Unfit for Babies)" as case may be.

## Evaporated Milk

Unsweetened condensed milk ; composition (see page 96) ; similar food value to raw milk but homogenisation renders it more digestible to infants ; lactose often caramelised by temperatures employed ; can be reconstituted into something approaching normal milk. Milk is preheated, pasteurised, condensed, superheated, and homogenised ; then cooled, filled into cans, sealed, sterilised ; latter process gives it long keeping quality. Defects are :

(*a*) Gassy Fermentation. Due to gas-producing organisms ; cans appear to be blown.

(*b*) Coagulation. Formation of hard curd which shrinks and is surrounded by whey ; bitter, cheesy taste.

(*c*) Bitterness. Accompanied with marked acidity ; due to presence of acid-producing organisms following faulty sterilisation.

(*d*) Fishiness. Due to inefficient sterilisation and sealing of cans.

(*e*) Curdiness. Due to raw milk with high bacterial content and excessive acidity ; excessive albumin content ; faulty balance of mineral salts ; high concentration of total solids.

(*f*) Sediment. Due to deposit of calcium and magnesium salts during sterilisation ; storage at low temperatures prevents deposit ; highly concentrated milk deposits most sediment.

(*g*) Fat Separation. Likely to occur if milk is not homogenised.

(*h*) Brown Colouration. Due to lack of homogenisation ; failure to add sodium phosphate or citrate as stabiliser ; too high sterilising temperature ; unsuitable pre-heating temperature.

Must be labelled either "Condensed Full-cream Milk, Unsweetened" or "Condensed Skimmed Milk, Unsweetened (Unfit for Babies)."

## Fermented Milks

Kefir. Made from whole or skimmed milk. Four varieties, viz. :

(*a*) Sweet. Twenty-four hours to produce ; contains little alcohol.

(*b*) Medium. Forty-eight hours to produce ; very effervescent.

(*c*) Strong. Three days to produce ; gaseous and contains fair amount of acid and alcohol.

(*d*) Very Strong. Very gaseous and exceedingly acid and alcoholic.

Said to have high food value ; much appreciated in Mediterranean countries and the Caucasus.

Koumiss. Fermented mare's milk in Asia ; produced from cow's milk in Europe and used for therapeutic purposes, milk sugar or whey being added ; high food value.

Yoghurt. Milk curdled by *Bacillus bulgaricus*. First preheated ; fermenting organisms then added. Good for digestive organs, development of lactic acid organisms opposing growth of any putrefactive processes in stomach or intestines ; taken medicinally when acidity is increasing ; may be obtained in tablet form.

Acidophilus Milk. Milk inoculated with essential organisms ; exerts a beneficial influence on digestive organs.

Kældermalk. Norwegian product ; boiled milk inoculated with a special variety of ropy milk ; large quantities of lactic acid and alcohol formed ; good keeping qualities.

## Ice Cream

Once regarded as luxury ; now staple article of diet ; difficult to define ; name often misnomer ; article containing no cream. Ice Cream Association of Great Britain have recommended following legal definition :

> "A frozen product containing not less than 8 per cent. milk fat and not less than 10 per cent. milk solids not fat."

Good quality article has high food value but excess is harmful. Bacteria which may be present in ice-cream are :

(a) PATHOGENIC. All pathogenic organisms present in milk may be present in ice cream. Bulk found are of human origin and have caused outbreaks of disease.

(b) NON-PATHOGENIC. Similar to those found in milk plus those found in raw materials.

Diseases caused by ice cream, often of epidemic type, are typhoid and paratyphoid fevers, dysentery, scarlet fever and septic throat, and food poisoning. Epidemics have similar characteristics to milk borne outbreak. (See page 83.)

Ingredients used are varied. Custard type ice cream contains milk, sugar, custard or ice cream powder together with gelatine to give consistency. Dairy type consists of cream, milk, sugar, sweetened condensed skimmed milk or milk powder, together with gelatine. Flavouring and nuts or fruit often added. Fertile source of contamination is poor quality gelatine.

For large scale manufacture it is important that premises should be as hygienic as dairy premises. Ingredients mixed ; mix is pasteurised, homogenised and cooled ; "aged" for twelve hours or longer at 34°–40° F. ; ageing assists rapid freezing which follows, rapid automatic freezers being employed ; then hardened at 0°–15° F. ; ready for packing and distribution. Efficient plant sterilisation essential. Defects found are :

(a) TALLOWY. Due to metallic contamination or poor ingredients ; prolonged storage emphasises defect.

(b) SANDY. Rough to tongue ; due to presence of milk sugar crystals caused by fluctuating temperatures in hardening room or dealer's cabinet.

High bacterial counts may be due to poor quality materials, unsatisfactory processing, faulty sterilisation of equipment, carelessness of employees. Samples for bacteriological and chemical examination should be taken at frequent intervals.

## Margarine

Cheap addition to fats ration with similar appearance to butter ; high sale on account of cheapness. Ingredients are animal and vegetable fats with addition of skimmed or separated milk. Two grades, special and ordinary. Special margarine usually contains whole milk and added vitamins A and D ; coloured with annatto in many cases.

In manufacture, fats are melted and blended, cooled separated milk of required acidity added and whole is churned ; thoroughly homogenised in churn at low tempera-

TABLE 4

*Chemical Composition of Various Milk Products*

| | Fat % | Casein % | Lactose % | Salts % | Water % | Remarks |
|---|---|---|---|---|---|---|
| Butter | 82·5 | 1·5 | 2·0 | 2·00 | 12·0 | — |
| Butter milk | 0·31 | 3·44 | 4·44 | 0·75 | 91·06 | — |
| Cheese (Cheddar) | 33·70 | 26·60 | 1·7 | 3·80 | 34·20 | Composition varies according to type |
| Cream (average) | 36·20 | 6·00 | 2·5 | 0·30 | 55·00 | do. |
| Condensed milk : | | | | | | |
| Whole milk | 9·1 | 8·40 | 12·2 | 1·9 | 24·4 | Cane sugar approximately 44 %. |
| Skimmed | 0·4 | 10·0 | 14·4 | 2·2 | 28·0 | do. 45% |
| Dried milk : | | | | | | |
| Whole milk | 28·16 | 30·42 | 33·50 | 6·10 | 1·82 | Average composition. |
| Skimmed | 1·50 | 37·70 | 48·50 | 7·90 | 4·40 | do. |
| Evaporated milk : | | | | | | |
| Whole milk | 9·10 | 8·75 | 12·74 | 1·94 | 67·47 | do. |
| Skimmed | 0·75 | 8·35 | 12·50 | 1·78 | 76·62 | do. |
| Ice cream | Average composition varies so considerably that standard analysis cannot be given. | | | | | — |
| Margarine | 83·2 | 1·8 | — | 0·4 | 14·6 | — |
| Whey | 0·38 | 0·86 | 5·0 | 0·76 | 93·00 | — |

ture ; decanted into receiving vats, removed to cold store and hardened ; finally packed in pats or boxed. Composition, see page 96.

Food value varies ; most nutritious when entirely made from animal fat ; high grade margarine has food value nearly equal to butter ; decidedly useful for cooking purposes.

Standards : Butter fat content limited to 10 per cent. of whole.
Moisture content restricted to 16 per cent.

Not subject to adulteration as it is cheaper than butter. Must be clearly labelled. Richer in anti-oxidants than is butter, so not subject to rancidity or other defects. Fraudulent deception often common, being served in lieu of butter in restaurants when bread and butter is ordered.

## Other Milk Products

Buddeised Milk. Treated for several hours at 125° F. with hydrogen peroxide. Bacteria destroyed ; pure hydrogen peroxide must be used and this is costly.

Iodised Milk. Milk to which organic iodine has been added ; useful for digestive affections.

Junkets. Made from milk curdled with rennet.

Lactalbumin. Obtained from whey ; used in manufacture of medicinal preparations.

Lactose. Produced from whey ; less sweet than cane sugar ; used for medical preparations, pills, and in preparation of humanised milk.

Infant Foods. Dried milk with or without additions ; good keeping qualities ; large quantities used in this country ; safe from disease-producing organisms.

Casein. Prepared from skimmed milk ; used for variety of proprietary food preparations ; may be hardened and used as plastic.

## Whey

By-product of cheese manufacture ; large quantities wasted annually. Should be greenish in colour ; contains sixteen times as much lactose and twice as much albumin as butter ; does not sour quickly ; useful for animal feeding ; has definite food value and high vitamin content. Used for bread making or made into *whey butter*, fat content being separated and churned ; can be dried to use as feeding stuff.

# MISCELLANEOUS FOODS

## CANNED FOODS

### General

Canned foods of all types now extensively used. Possess following advantages :

(*a*) Keep sterile for lengthy periods.
(*b*) Facilitate preservation of foods during glut for use in times of shortage.

The two essentials are heat treatment and expulsion of air. Temperature employed for sterilisation depends on nature of food and size of can. Cans made of tinplate ; usually lacquered.

SANITARY CAN. No solder or minimum amount used ; *made airtight by means of double seams ;* tops and bottoms clamped on ; absence of solder important if can is used as fruit container.

### Methods

MEAT. Types usually canned are beef, mutton, pork, tongues and hams ; 12 oz. and 6 lb. common sizes. Meat is *boned, trimmed ; placed in pickle,* either hot or cold, for several hours ; meat then examined and all superfluous fat, small pieces of bone, gristle and inedible material removed ; meat partially cooked (2½ hours) ; cut up, filled into cans, liquid being added to form jelly ; cans capped ; vacuum sealed or exhausted, vent hole being sealed ; cans processed or sterilised, time and temperature depending on size of can ; *usually five hours at 230–240° F. ;* cans cooled ; degreased, lacquered and labelled ; stored at 37°–42° C. and kept under observation for few days ; faulty cans removed ; rest packed and shipped.

FISH. See pages 75 and 76.

FRUIT. Fruit prepared, peeled, cored, blanched or just cleaned ; must be sound and free from bruises ; sometimes washed ; fruits packed into cans and hot thick syrup added ; air exhausted ; lids fixed ; cans processed, time depending on type of fruit ; cooled, dried and labelled. Cans have concave ends after cooling. Inspected for leaks.

VEGETABLES. Cleaned and cut up if necessary ; must be sound ; cans filled, salt water added. Then processed as for fruit.

GLASS PACKING. Very popular ; advantages are :

(*a*) No danger of metallic contamination.

(b) Condition of food seen at glance.

(c) Vacuum sealing apparatus not required.

Glass more expensive and easily broken ; glass splinters may enter foodstuffs. Food cooked, placed in container ; sealed with metal cap ; no vacuum process necessary as seal formed with cap ; contents keep sterile for fairly lengthy period, depending on storage temperature ; cap has rubber washer

**Inspection**

Dangers may arise from canned good due to changes in contents, use of preservatives, use of colouring agents, impurities from container (tin), defects in canning. Methods of inspection are :

(a) SUPERFICIAL. For indentations, rust holes, blown, leaking. Stained cases usually denote leaking cans ; bulging cases show blown cans ; rusty cans should be carefully inspected ; second ventholes regarded with suspicion.

(b) PALPATION. Ends of cans bulging instead of concave or flat ; detected by pressing with fingers on ends ; when blown, ends are irreducible ; "springers" are cans, ends of which are reduced by pressure ; some acid fruits give blown appearance but fruit often quite sound. Blown cans condemned ; may be due either to bacterial action following inefficient sterilisation or corrosion of metal container.

(c) PERCUSSION. Tapping by wood or finger ; sound can emits dull note ; drum-like note if gas is present ; any can failing to give dull note in every part rejected.

(d) SHAKING. Usually used on cans of meat ; advanced state of decomposition with liquid present easily denoted ; cans rejected.

Certain points require special mention.

(a) SLACK CANS. Can not quite filled ; sterilised air in can ; usually normal in appearance ; percussion may cause sound like that from blown can.

(b) HYDROGEN SWELLS. Action of organic acids in contents acting on tin and iron ; hydrogen gas liberated ; may burst can. Causes are low acidity, lacquer used internally to prevent discolouration ; presence of sulphides ; inefficient cooling after processing ; storage at high temperatures ; absorption of tin salts by contents with exposure of iron ; inefficient exhaustion.

(c) LEAKING CANS. Usually bursted through gas production causing perforation of weak point in can. Causes are similar to those causing hydrogen swells.

(d) CORROSION. Cause formation of pin-holes (leaking cans) ; discolouration of contents and blown cans.

(e) Flat Sours. Can appears normal but contents sour and unsound.

### Imported Canned Foods

Ten per cent. of cases are examined ; if more than 2 to 2½ per cent. rejected, all cases in consignment are examined.

## OTHER FOODS

### Aerated Waters

Flavoured water charged with carbonic acid ; may be contaminated through impure water supply, sour flavouring matters, impure carbon dioxide or metallic contamination. Soda water must not contain preservative. Cordials and fruit juices may contain 350 parts of sulphur dioxide or 600 parts benzoic acid per million. Brewed ginger beer may contain up to 120 parts benzoic acid per million. Sweetened mineral waters may contain up to 70 parts sulphur dioxide or 120 parts benzoic acid per million.

### Beverages

Cocoa. Powdered seed of fruit of cocoa plant ; exposure to sun causes loss of flavour ; adulteration rarely occurs.

Coffee. Coffee beans roasted and ground. Adulterated with chicory (root of plant of dandelion family), beans, maize, corn, peas, acorns, carrots, etc. Chicory may also be adulterated in similar fashion. Admixture of chicory detected by placing some of the suspected mixture on water ; chicory sinks ; coffee floats.

Tea. Dried leaves of tea plant ; flavour varies with country of origin ; most teas blended by admixture of various types ; strongly flavoured substances impart their flavour to tea if it comes into contact with them ; tea imported in damp state rejected at port of entry. Adulterated by addition of used dried tea-leaves, leaves from sloe, elder, and willow, prepared and added. Coloured with different ingredients to improve colour of leaves. Adulteration very rarely occurs at present time but sand, iron filings, gum and rice have been used as adulterants.

### Bread

Most important commodity made from flour, yeast and water ; sold wrapped or unwrapped, wrapped bread being preferable. Baking renders bread light and digestible ; brown bread also finds a ready sale, while rye, maize and rice flours are used in breadmaking. Good wheat bread is white in colour ; sourness may be due to sour dough, bad yeast or

old flour ; sourness denoted by yellowness, sour taste and smell. Subject to abnormalities :

(*a*) ROPINESS. Threadlike condition, sticky ; disagreeable odour and taste.
(*b*) COLOURING. Red or violet streaks ; due to organisms present in bakehouse ; not noticeable until cut.
(*c*) MOULDS. White, blue, green ; affect bread when stored in warm moist air.

To prevent abnormalities, cool quickly, store in cool place, and exercise strict cleanliness.

## Cereals

ARROWROOT. Fine starchy powder ; may contain ground rice ; acquires musty odour and taste under damp conditions.

RICE. Imported as grain, in flakes or flour (ground rice) ; usually polished with talc ; *polishing destroys vitamin B* content by removal of outer layer ; grains become maggoty if stored in warm place ; maggots similar in colour to rice.

SAGO. Farinaceous food ; imported in large quantities.

SOYA FLOUR. Prepared from soya bean ; bean rich in milky fluid ; flour used by confectioners as substitute for milk powder ; sometimes used for breadmaking and for cooking . Very nutritious.

TAPIOCA. Similar food to sago only grains are smaller.

## Corn

WHEAT. Most important grain ; used for manufacture of flour ; comes in mixed from many countries ; first passed through separator to remove extraneous dirt ; washed, dried by warm air, then cooled ; passes to spiral wheel which rotates, flinging off grain at different points. Grain then conditioned in emery scourer, husk being carried away by current of air. Grain passes to solid steel rollers which possess finely grooved spirals on their surfaces and is ground ; graded by passing through large rectangular box which makes constant rotary movement ; then passed through silk sieves which determine fineness ; coarse remains known as bran ; wholemeal flour contains bran and is used for manufacture of wholemeal bread. *Bleaching* is a chemical process ; hydrogen peroxide or sulphurous acid gas used ; if latter, hydrogen peroxide required later to remove sulphites ; flour changed from

smooth to touch, heavy and when squeezed in the hand should retain shape.

Bad Flour is sour, yellow in colour, gritty, lumpy and sticky or moist and acid to taste. May be adulterated with alum.

Self-raising flour contains baking powder; improvers are sometimes added to improve gluten standard.

Oats. Used for manufacture of oatmeal and oat flakes.

Barley. Used in soups, broths and for brewing.

Rye. Consumed as black rye bread.

Maize. Used for cornflour and animal feeding; soon becomes rancid on exposure to air but is highly nutritious.

Parasites in Corn. Generally found are Mediterranean flour moth, flour beetles, flour mites and weevils. Carbon bisulphide is used to destroy these pests while heating the grain destroys.

Diseases of Corn. *Bunt.* Attacks wheat and grows within grain which is found to be filled with a dark brownish powder which is greasy to touch and has disgusting fish-like odour. Gives bread a bitter taste and may produce diarrhœa.

*Ergot.* Attacks rye; grain turns black and can be recognised by large size; may be separated by sifting; causes ergotism, symptoms of which are vomiting, diarrhœa and, in extreme cases, paralysis.

*Moulds.* Various types of mould may affect corn stored in a warm damp place.

*Smut.* Attacks wheat, oats, barley and rye; develops finer powder than does bunt but has no smell. Bread has very disagreeable taste; effect on human beings not known.

## Confectionery

Cakes. Many substitutes used in manufacture; reconstituted cream, liquid and dried eggs, egg substitutes and baking powders employed; chemicals employed for aeration are sodium and potassium carbonates, ammonium carbonate, alum with bicarbonate of soda and tartrates; flavours employed are lemon, vanilla and ginger essences, orange oil, almond oil and essence. Cochineal principal colouring agent but saffron (yellow) and chlorophyll (green) also used; metallic and coal tar dyes prohibited.

Biscuits. Very popular food; keep sound for long periods: cream fillings soon become rancid; turn mouldy under damp conditions.

Chocolates. Very important article of confectionery; no chemical standard; some high-grade, some very poor quality with starchy taste, greyish or bluish-grey bloom; sometimes become infested with maggots when unfit for food; nut chocolate often affected in this manner. Boiled sweets have

artificial essences and colouring matters ; should be frequently sampled. Wrapping of all sweets or their protection from contamination during sale essential.

## Dried Fruits

APRICOTS. Should look bright and be firm to touch ; when damaged by water are soft and spongy ; should not be mouldy, maggoty or sugary ; sulphur dioxide, not more than 2,000 parts per million, allowed as preservative.

CURRANTS. Sun-dried grapes from Greece and Australia ; usually dirty when received ; should be tested by the handful ; have dry pleasant smell ; ferment when damp ; worms often found in Australian currants.

DATES. Best quality, large, soft and moist ; packed in boxes. Poor quality dates packed in large cases ; pressed dates often dry and sugary ; will ferment if damp ; become infested with insects in warm weather ; date smut causes dates to become powdery mass.

FIGS. Dry but soft on outside ; soft and luscious on inside ; should be firm in texture but not rough ; several boxes should be examined as packers sometimes place large figs on top layers and inferior figs known as "naturals" lower down. Affected with smut in similar fashion to dates.

PRUNES. Dried plums ; become dry and have white appearance when stored for long periods ; steamed to refresh them.

RAISINS. Sun-dried blue grapes ; imported from Spain, Australia and California (seedless) ; seedless type crystallise and exude grape sugar. 750 parts per million of sulphur dioxide allowed as preservative.

SULTANAS. Should be pale golden colour, even in size ; free from black or red berries, stones, seeds, kernels and should not be sticky. Skins should be delicate and thin. Preservatives allowed as for raisins.

Peaches, apples and pears are also sold in dried condition ; preservatives as for apricots.

## Eggs

Usually hens' eggs sold but also eggs of ducks, geese and turkeys are sold occasionally. Termed "New Laid" up to fourteen days old ; large quantities imported in cold storage ; trade recognises three types, *New Laid, Fresh and Cooking*; eggs will keep fresh for several weeks in good dry storage.

| | | | |
|---|---|---|---|
| Constituents are : | Water | 73·5 | per cent. |
| | Fats | 11·6 | ,, |
| | Proteids | 13·5 | ,, |
| | Salts | 1·4 | ,, |

Fresh eggs have glazed shells with bloom on them ; not more than ¼ inch space between contents and top of shell ; egg heavy for size ; yolk floats in white ; when opened, egg should have pleasant odour ; white clear, yolk yellow, no spots.

TESTS FOR FRESHNESS. *Brine Test.* Two ounces of salt dissolved in 1 pint of water ; fresh eggs will sink in the liquid, while if bad will float in various positions.

*Candling.* Light projected through egg ; fresh eggs are clear, while if bad show spots.

*Shaking.* Fresh egg gives no sound when shaken, while bad egg does.

PRESERVATION. *Water Glass.* Silicate of soda added to water ; eggs covered with liquid.

*Lime Water.* Four parts of slaked lime, 20 parts of water and 1 part salt mixed and allowed to stand for a week ; clear liquid drained off and poured over eggs to be preserved.

Eggs treated by either of these two methods are readily recognised as shell is rough.

*Cold Storage.* Large numbers of eggs are stored in cold storage. If stored at temperatures below 33° F., should be rotated occasionally to prevent yolks adhering to shells.

*Bran.* Placed in layers surrounded by bran.

*Butter.* Eggs rubbed over with butter.

*Dried.* Yolks and white beaten together and then dried ; yolks or whites may be dried separately ; liable to sourness and rancidity while tallowness may develop if moisture content too low.

*Liquid Eggs.* Imported from China, Australia and America ; received in tins, 14–17 lb. weight, frozen ; used chiefly by bakers ; rapidly decompose after opening.

Preserved eggs may be detected by applying a drop of phenol-phthalein to shell ; purple stain produced if preserved.

GRADING. All home produced eggs are now graded and marked ; imported eggs marked with country of origin.

DEFECTS IN EGGS.

*Black or Red Rot.* Yolks red or black ; very dark on candling ; condemned.

*Blood Spot.* Drop of blood adheres to yolk ; can be used for cooking if spot is small ; detected by candling ; decompose if stored for long periods.

*Fishy Taste.* Often found in imported eggs ; not discovered until cooked ; usually due to feeding materials.

*Mould.* Presence of moulds on shells warrants condemnation ; usually found on cracked eggs which decompose quickly.

*Musty Odour.* Usually sour ; such eggs possess a high bacterial content and should be condemned.

*Staleness.* Increase in size of air space and in density of albumin content ; egg when opened has unpleasant odour ; condemned.

*Watery White.* Eggs with watery whites are detected by candling.

### Fermented Liquors

BEER. Includes ale and stout ; made from malt and hops ; glucose and invert sugar sometimes added in lieu of malt and quassia for hops ; if glucose is used with malt, arsenic may be found in beer ; preservative allowed is 70 parts sulphur dioxide per million.

CIDER. Fermented juice of apples ; quickly sours and acidifies ; does not keep long ; sulphur dioxide permitted up to 200 parts per million.

SPIRITS. Several types made by the distillation of alcohol.

*Brandy.* Distillation of fermented grape juice ; alcohol content 45–55 per cent.

*Gin.* Distilled from fermented grain ; mixture flavoured with oils of juniper and turpentine and sugar ; alcohol content 50–70 per cent.

*Rum.* Distilled from fermented molasses (cane sugar residue) ; colouring due to burnt sugar ; alcohol content 50–60 per cent.

*Whisky.* Distillate of fermented barley, corn and rye ; alcohol content 40–50 per cent.

*Spirits must not be more than 35 degrees under proof;* principal adulterant is water.

### Fruit

Two types of fruit : hard—apples, pears, etc., and soft—raspberries, strawberries, etc. ; soft fruit quickly decays especially if over-ripe, bruised or damaged—putrifies quickly under damp and warm conditions ; over-ripe or decayed fruit when consumed may cause diarrhœa or intestinal trouble.

APPLES. Large quantities imported ; principal diseases are :

(*a*) *Ripe Rot.* Brown sunken spots ; apples dry ; skins wrinkled and yellowish ; white outgrowths on surface.
(*b*) *Apple Scab.* Black scabs on skin ; no damage to fruit.
(*c*) *Glassiness.* Watery fleshed ; often found.
(*d*) *Brown Heart.* Due to bad ventilation in ships' holds, and presence of abnormal quantities of carbon dioxide ; patches of delimited brown tissue.
(*e*) *Bitter Pit.* Shallow pits over surface ; areas of brown dead flesh underneath.

APRICOTS. Similar to peaches but smaller and yellower.

BANANAS. Solid fruit ; little moisture content ; frost causes them to become unfit for sale.

CHERRIES. Affected with numerous pests, brown rot fungus and moulds.

CURRANTS. Black, red and white ; easily damaged ; very perishable.

GOOSEBERRIES. Red, yellow, white, green ; red and yellow types easily damaged ; affected by gooseberry mildew causing glistening white spots on fruit.

GRAPES. Highly nutritious ; mildew attacks plants causing fruit to shrivel ; easily damaged ; quickly ferment.

GRAPE FRUIT. Similar to large orange ; lemon coloured when sold ; subject to moulds which cause rapid deterioration.

LEMONS. Anti-scorbutic properties ; used in manufacture of medicinal preparations ; subject to blue and green moulds which cause rapid deterioration.

MEDLARS. Similar to pears in shape ; eatable only after "bletting," in which condition appear decayed but are quite eatable.

ORANGES. Several types with special varieties, such as :

(*a*) Blood oranges—red streaks in flesh.

(*b*) Navel—seedless, all seeds in peculiar protruberance at top.

(*c*) Tangerines—small, seedless, usually wrapped in tinfoil.

All oranges subject to moulds which reduce them to sodden condition.

PEACHES. Easily damaged ; affected by larvæ of common fruit fly which produce decay near stone.

PEARS. Soft and hard types ; soft type easily bruised and damaged ; subject to rapid decay ; affected with apple scab, glassiness and bitter pit.

PINEAPPLES. Can stand rough usage ; long keeping ; affected by black heart disease turning middle of fruit black. Putrefaction causes brown patches ; becomes soft and pulpy.

PLUMS. Attacked by grub and fungoid diseases ; silver leaf is chief ; fungus causes them to shrivel and become tasteless ; sometimes sharp or sour ; perishable fruit ; brown rot causes decay. Damsons and greengages also affected.

PUMPKINS. Belong to marrow family ; rind deep yellow and flesh watery.

QUINCES. Resemble pears.

RASPBERRIES. Soft red fruit ; very perishable.

STRAWBERRIES. Soft fruit ; softer and wetter during bad summer ; "Leather jackets" cause much damage ; often seen in dirty condition owing to habitat ; very perishable.

TOMATOES. Numerous varieties ; easily bruised or damaged ; such fruit quickly decays ; attacked by :

(*a*) *Black Rot.* Caused by fungus ; produces sunken patches coated with black mould.
(*b*) *Black Heart.* Blackened around stalk penetrating to centre ; due to prolonged cold storage.

Brown patches appear sometimes on skins ; eat into flesh and decomposition follows.

CRYSTALLISED FRUITS. Fruit covered with sugar syrup ; whole allowed to cool ; fruits when removed from mass covered with sugar ; good keeping qualities in cool atmosphere ; 100 parts sulphur dioxide per million allowed as preservative.

## Nuts

Highly nutritious but indigestible ; valuable source of food supply ; rich in protein and fat ; oily matter contained resists fermentation and shells allow of long storage ; subject to rancidity, tasting soapy, eventually turning black and drying up ; bad nuts lighter than when sound ; if bulk of any consignment is bad, whole should be condemned. Thin-shelled nuts more often bad : dampness affects all nuts. Common kinds are almonds, brazils, chestnuts, coco-nuts, hazelnuts, peanuts and walnuts.

## Preserves

Jam and marmalade ; standards : full fruit 30-45 per cent. fruit ; lower fruit 20 per cent. fruit. Preservatives limited to 40 parts per million sulphur dioxide. Good jam consists of equal parts fruit and sugar ; glucose used in lieu of sugar in cheaper varieties ; cheap glucose may cause arsenical contamination. Gelatine sometimes used for thickening. Cannot be manufactured from decomposing fruit but softened fruit can be employed if free from mildew, fermentation or decomposition. Fruit pulp used in large quantities. Preservatives allowed in fruit pulp are :

| | | | |
|---|---|---|---|
| Cherries . . | 3,000 parts sulphur dioxide | per million. | |
| Strawberries and raspberries . | 2,000 | do. | do. |
| Other fruits . | 1,500 | do. | do. |

Rarely adulterated at present time.

## Sugar

CANE SUGAR. After refining is white in colour ; syrup and treacle prepared from molasses ; this is residue of refining

process ; sometimes coloured by caramelisation or vegetable dyes and sold as Demerara or brown sugar at higher price.

BEET SUGAR. Manufactured from sugar beet; large quantities grown in this country ; welcome addition to sugar supplies ; cannot be distinguished from cane sugar.

MAPLE SUGAR. Used chiefly for culinary purposes or as low-grade sweetener ; when refined is almost pure white.

GLUCOSE. Grape sugar ; technically dextrose ; made from maize or corn starch ; if inefficiently manufactured may contain traces of arsenic due to sulphuric acid used for preliminary treatment.

FRUCTOSE. Fruit sugar ; found in honey ; keeps sound for lengthy periods.

Preservatives allowed :

| | |
|---|---|
| Sugar, solid glucose and cane syrup . | 70 parts sulphur dioxide per million. |
| Liquid glucose and corn syrup. . | 450 do. |

## Vegetables

Source of carbohydrates, vegetable acids and mineral salts ; raw vegetables contain vitamin C ; green vegetables contain numerous caterpillars, grubs, or even tapeworms on leaves.

ASPARAGUS. Young shoots only used, as when old very acrid ; often damaged by asparagus fly and beetle.

CABBAGE. Include cabbage, sprouts, kale, broccoli and cauliflower. Often suffer from "black rot" ; leaves discoloured brown or black.

CELERY. Generally eaten raw ; bright and crisp when fresh ; coarse and stringy when stale ; may suffer from "brown rot," hearts becoming rotten.

CUCUMBER. Eaten raw ; contain little nutriment ; very indigestible ; keep for long periods when undamaged.

LETTUCE. Eaten raw ; must be thoroughly washed ; typhoid fever has been caused by infected imported lettuce.

MARROW. Very watery ; decays quickly if bruised ; subject to "brown heart," unsoundness of core.

ONIONS. Used for flavouring or pickling (small variety). Firm when good, when bad, soft and pulpy ; onion fly causes decomposition. Shallots or leeks much similar.

RHUBARB. Stalks only used ; leaves poisonous ; juice is oxalic acid ; often forced for early sale ; forced type is more watery and not so nutritious ; injured quickly by frost.

SPINACH. Wholesome and easily digested ; contains large quantities of chlorophyll.

WATERCRESS. Grown in shallow water; pungent and pleasant flavour; high medicinal value; eaten raw; water in which it is grown should be perfectly pure; bacteriologically examined at intervals; typhoid may be carried by cress grown in polluted water; brown jelly deposited on stem indicates stagnant water.

All the above known as green vegetables; possess little starchy matter; much cellulose (indigestible) acids and salts. Soon lose freshness; leaves become withered and lank; firm and brittle when fresh; have objectionable odour when decaying.

Many varieties of roots and tubers as follows:

ARTICHOKES. Two types: Jerusalem, eaten like potatoes, and common type, eaten either raw or boiled.

BEETROOT. Contains sugar; nutritious.

CARROTS. Orange coloured; wholesome and nutritious; larvæ of carrot fly spoils roots; do not keep well; become soft and mouldy.

PARSNIPS. Contain much starchy matter; peculiar taste and texture; woody when old.

POTATOES. Large quantities grown in this country and imported from abroad. If sound flesh should be clear and firm, of even density and crisply separate. Good cookers cling to knife. Contain large amount of starchy matter. Diseases are:

(*a*) *Corky Scab.* Parasite; localised, small dark-coloured slightly raised patches on surface; later ruptured and dense mass of brownish or snuff-coloured spore balls exposed.

(*b*) *Potato Scab.* Fungus; common disease; appears as patches or scabs on exterior, which may be covered. Affects market and not food value.

(*c*) *Potato Disease.* Attacks leaves first and then travels down stem to tuber; brown spots on surface; becomes rotten.

(*d*) *Wart Disease.* Also known as "Black scab"; when attacked warts or wrinkles appear near "eyes" of tuber; grow together and form brown spongy scab; become black and unwholesome.

(*e*) *Winter Rot.* Common; gradual depression and shrivelling of portion of surface which is covered with patches or fungus; inside reduced to soft, fœtid mass but skin remains intact.

RADISHES. Pungent taste; constituent of salads; watery and contain little nourishment.

TURNIPS. Contain pungent oil but little nourishment; woody and coarse when old; "black rot" causes roots to rot; swedes are largest type of turnips, pink when boiled.

PULSES

Contain large amount of protein. Several types :

BEANS. *Broad*—removed from pod, wholesome food, hard to digest if old.

*French.* Pods with small beans, sliced and boiled as green vegetable. *Runner Beans* treated similarly.

*Haricot.* Very nutritious ; sold in dried state ; contain a little fat and are rich in starch and protein.

*Butter.* Like haricot beans but larger.

PEAS. Nutritious ; contain more sugar than beans ; subject to attacks by maggots ; sold both fresh (in pods) and dried.

LENTILS. Orange-coloured pulse used for soups and stews.

EDIBLE FUNGI. Chief edible fungi are *mushrooms* ; contain much water and little nitrogen ; some people allergic to these fungi, skin breaking out in rash soon after eating ; have pleasant odour. Must not be confused with poisonous fungi which have pale brown colour and soft flesh, are slightly fibrous, have pale gills and exude milky fluid. Edible mushrooms have liver-coloured gills, concave top covered with white velvety skin which peels easily, flesh is compact, brittle and slightly moist. When *stale* are dull and have no fresh smell, taste bitter and are soft and watery ; sometimes infested with maggots. Cultivated mushrooms sometimes attacked by parasitic fungus which causes rapid tissue decay with strong odour ; stem is considerably enlarged.

## Vinegar

Diluted acetic acid prepared from either fermented grape juice, malt, or the distillation of wood (wood vinegar). May be artificially manufactured (coloured and flavoured acetic acid). Vinegar contains 4–8 per cent. acetic acid ; if below 4 per cent. should be considered adulterated. Should not contain more than 0·1 per cent. sulphuric acid ; this acid may be present in vinegar. Good vinegar should be clear, bright, dark brown in colour, strong sour taste and smell. If acetic acid content is reduced is paler in colour and has dull or cloudy appearance. Becomes weaker with storage on account of reduction of acid content.

# FOOD POISONING

## Causative Organisms

Much research work necessary to elucidate all organisms causing food poisoning ; four main groups.

(1) SALMONELLA GROUP. Over twenty different strains discovered ; most important are :

(*a*) *Salmonella enteritidis*. Similar to *Bacillus coli* and *Bacillus typhosus* ; cause of sepsis in animals ; usually present in intestines of food animals.

(*b*) *Salmonella ærtrycke*. Frequent cause of food poisoning ; resembles *Sal. enteritidis* ; cause of enteritis in rodents.

Organisms of this group are non-sporing ; easily cultivated ; grow readily in food substances at ordinary temperatures ; destroyed by cooking ; form toxins which resist temperatures of 100° C. ; food affected is not decomposed.

(2) TYPHOID GROUP. *Bacillus paratyphosus A* and *B* and *Bacillus suipestifer* have been the cause of outbreaks.

(3) DYSENTERY GROUP. *Bacillus dysenteriæ* may be cause ; symptoms similar to those following infection with Salmonella group and not those normally found in cases of dysentery.

(4) BOTULISM GROUP. *Bacillus botulinus* chief cause ; several types exist ; not poisonous in itself but acts through its toxic products ; does not require oxygen for growth ; usually infects canned goods and sausages ; occasionally causes decomposition with sour, rancid odour or taste ; spore-forming organism ; not so resistant to heat as Salmonella group ; pickling prevents growth ; toxins very poisonous ; destroyed by heating for thirty minutes at 80° C. ; spores more resistant ; in acid foods, heating for fifty minutes at 100° C. required ; in less acid foods, 100° C. for 180 minutes necessary.

(5) OTHER ORGANISMS. Staphylococci have occasionally caused outbreaks. Further investigations will probably enable additional types of organisms to be classified as producers of food poisoning.

## Symptoms

BACTERIAL FOOD POISONING. Similar to gastro-enteritis ; vomiting, abdominal pains, diarrhœa ; severity depends on absorption of toxins ; symptoms mild if no absorption takes place. If absorbed, severe intestinal disturbances occur ; pass off as toxins eliminated ; prostration follows. Toxic poisoning marked by rapidity of onset ; two to three hours

after consumption of infected food. If bacterial infection only, symptoms less severe but fever, muscular pains and prostration occur later ; incubation period twelve to twenty-four hours. Mixed infection causes shorter incubation period.

BOTULISM. Onset more protracted ; eighteen to thirty-six hours ; intestinal symptoms not always present in initial stages ; blurred vision, giddiness, muscular weakness and cramps, dryness of mouth and throat, difficulty in swallowing, loss of speech, no abdominal pain and only slight diarrhœa.

### Mode of Infection

HUMAN ORIGIN. Individual affected may infect others ; "carriers" also known ; secondary infections usually occur in ten to fourteen days ; infection due to organisms of human origin extremely rare.

ANIMAL ORIGIN. Cattle, calves and pigs infected with organisms of Salmonella group ; direct infection of meat or milk ; organisms may be conveyed from animal to otherwise sound food ; rats and mice are causes of food infection ; thought but not proved that flies may also carry infection ; mode of infection not always obvious ; most common infections are of animal origin and from external sources.

### Foods Affected

Generally cooked, prepared or made-up foods and those receiving considerable handling or treatment ; canned meat and salmon commonest causes of poisoning by Salmonella group ; generally due to toxins not destroyed in processing ; canned fruits and vegetables affected, as are sausages, meat pies, brawns, potted meat and similar made-up foods ; often prepared under unsatisfactory conditions. Ducks' eggs have caused outbreaks, usually due to *Salmonella œrtrycke* ; milk, ice-cream, cheese, usually Canadian cheddar, have also been the cause while oysters, shrimps, cockles and whelks are liable to infection with Salmonella, as are fresh fruits such as apples.

### Investigations

(1) SAMPLING. All small scraps or pieces remaining from a meal removed ; in case of canned food, can and small pieces adhering to it taken ; label also retained and any unopened tin containing a similar article collected for examination. All sales of suspected food stopped ; if foodstuff causing outbreak definitely known, remaining stock seized.

*Canned Foods.* Sale stopped and 10 per cent. of bulk bacteriologically examined ; if this percentage free from organisms, consignment sold : if any infection discovered, whole consignment destroyed

*Prepared or Made-up Foods.* Sample of food and various ingredients obtained for bacteriological examination.

*Milk.* Large number of samples required from each source of supply ; when infected supply located, samples taken from each cow ; animals with diarrhœa noted. Samples to check plant and utensil sterilisation essential.

*Transport.* Samples of all foods except unopened canned goods placed in sterile, wide-mouthed, screw-topped jar ; packed in ice.

Specimens of excreta or stomach contents placed in wide-necked bottles with tight-fitting stoppers ; also packed in ice.

Organs from fatal cases packed in 30 per cent. solution of glycerine.

Delivered to laboratory by hand or by passenger train with least possible delay.

(2) INQUIRIES. Steps taken and information required as follows :

(*a*) List of cases obtained from local practitioners and householders with particulars of food suspected.

(*b*) Names and ages of persons in each affected household together with those who have eaten food and those taken ill.

(*c*) Incubation period and symptoms.

(*d*) Previous intestinal illnesses prior to outbreak.

(*e*) Condition of premises.

(*f*) Food implicated ; date of purchase ; where obtained ; any abnormal appearances ; whether eaten cooked or uncooked.

(*g*) Particulars of samples obtained for examination.

(*h*) Preparation premises ; workers employed and previous illnesses.

(*i*) Origin of ingredients ; details of storage, preparation, cooking and cooling.

(*j*) Cleanliness of premises and plant and methods of sterilisation.

(*k*) Drainage and sanitary fittings ; accumulations of manure and refuse.

(*l*) Rat or mice infestations and prevalence of flies.

## FOOD SAMPLING

### Objects.

To prevent fraud by substitution and injury to health.

### Sampling

Basis, three samples per 1,000 population of all articles; should be systematic so that all vendors are dealt with; articles sampled should cover as wide a range as possible; prevailing adulterations to be borne in mind.

Two types of sample, formal and informal; assistant should be taken in all cases of formal sampling to provide corroborative evidence. Informal samples sometimes act as a deterrent; may detect defects in storage, sale or distribution.

### Equipment

(1) Suitable wide-necked, screw-capped jars and narrow-necked bottles for transmission of samples; should be dry and clean.

(2) Jug and funnel for filling bottles in case of liquids.

(3) Corks for bottles.

(4) Envelopes for powders, etc., and grease-proof paper.

(5) Seal, sealing wax and tapers or candles for sealing bottles, jars and envelopes.

(6) Knife, fork and spoon for dividing samples.

(7) Notebook and labels for bottles, jars, etc.

(8) Clean towel or duster.

(9) Plunger.

Authority to take samples should always be carried.

### Purchase of Samples

Article required clearly stated and normal quantities demanded (see Table 5 below); must be sufficient for analysis; analyst will state quantity desired; before making purchase, sampling officer should have decided what is to be obtained; ordering and paying should be carried out by one person; purchase of each sample distinct and separate; actual amount of money required to be tendered. Food normally sold in unopened containers must be bought in such containers; goods sampled should be of same manufacture. Detailed and accurate notes kept of all statements and matters relating to transaction. Original containers and wrappers retained for use in case of prosecution. On completing

purchase, vendor immediately notified that article purchased is to be analysed by Public Analyst.

**Division of Samples**

Most samples easily divided into requisite three parts, but certain foods require special treatment.

MILK. Contents of bottles thoroughly mixed ; should be well shaken, cap removed, liquid poured into jug, returned to bottle, this operation being carried out three times. Loose milk in churns and cans to be plunged rapidly six times or poured from can to can three times ; must not be mixed with dipper.

BREAD AND BUTTER. Slices purchased placed butter to butter ; each sandwich divided into three parts.

BUTTER, LARD AND OTHER FATS. Portions not wrapped in paper but placed in wide-mouthed jars without pressure being exerted in order that water content does not exude.

SAUSAGES. Each sausage divided into three parts.

JAM, CONDENSED MILK, ETC. Thoroughly mixed before division ; container for jam to be of exact size required. Care taken that sugar content of condensed milk is equally divided as should fat layer on upper surface of potted meats and pastes.

BOTTLED PREPARATIONS. If more than one bottle is obtained, mix contents before division.

MIXED ARTICLES. Tinned peas, fruits, sardines in oil and any canned goods containing liquids. Liquids should be divided as equally as possible. Each large solid part divided into three parts.

FRUITS. Whole fruits cut into three portions.

SPIRITS. To be properly mixed before division.

PRESCRIPTIONS. Height of liquid in bottle in which sold marked, so that analyst can measure total quantity and check directions for dosage. Medicines containing sediment well shaken before division.

POWDERS. One dozen of same variety obtained all of same make, well mixed and divided.

FISH. When scarce, substitution sometimes occurs. Care taken in dividing sample that portion intended for expert examination should bear some distinguishing mark, such as lateral line, for identification.

AUTOMATIC MACHINES. Sample divided in usual manner ; one portion forwarded by registered post to owner of machine.

SAMPLES IN COURSE OF DELIVERY. Samples of foods *but not drugs* may be taken in course of delivery on request ; *not purchased but taken*. No consent necessary in case of milk ; officer must be present at time of delivery. Sample obtained

TABLE 5

*Quantities Required for Formal Samples*

| Article | Quantity Required | Article | Quantity Required |
|---|---|---|---|
| Bacon | ½ lb. | Milk and cream | 1 pint |
| Baking powder | ½ lb. | Mineral waters | 2 pints. |
| Beer | 1 pint | Mustard | 4 oz. |
| Black puddings, polonies | 1 lb. | Oatmeal | ½ lb. |
| Bread | 1 loaf | Oils (various) | 4 oz. |
| Bread and butter | 12 slices. | Pepper | 2 oz. |
| Butter and other fats | 1 lb. | Preserves | 1 lb. |
| Cake | ½ lb. | Pulses | 1 lb. |
| Canned or bottled fish, fruit or vegetables | 1 lb. | Rice, sago, tapioca | ½ lb. |
| Canned or bottled meats or pastes | ½ lb. | Salt | 1 lb. |
| Cheese | 1 lb. | Sauces | 2 pints |
| Coffee, cocoa, chocolate | ½ lb. | Sausages | 1 lb. |
| Condensed or dried milk | 4 oz. | Spirits | 3 doubles |
| Cooked meats | ½ lb. | Spices | 2 oz. |
| Cordials | 8 oz. | Suet | ½ lb. |
| Dried fruits | 1 lb. | Sugar | 1 lb. |
| Drugs | 4 oz. | Sweets | 1 lb. |
| Eggs | 1 doz. | Tea | 4 oz. |
| Flours (various types) | ½ lb. | Vinegar | 10 oz. |
| Fresh fruit | 1 lb. | Wines | 1–2 pints |
| Jellies | ½ lb. | Yeast | 4 oz. |

either from each churn or from a mixture from all churns; analyst informed of quantities in various churns; note made of time and place of sampling, method of transport, how milk was mixed, condition and marking of churns. Accompanying labels retained and gallonage stated on label checked.

SAMPLING IN OTHER DISTRICTS. Sampling officer may take sample in districts of other Local Authorities. If taken by officer of one district at request of officer of another district, certificate stating that provisions of Food and Drugs Act, 1938, have been complied with must be produced or officer must be called as witness. Copy of certificate together with copy of Analyst's certificate served with summons.

APPEAL TO COW. Taken with consent of, or at request of producer; marked "Appeal to Cow." Several inspectors may have to be present so that entire milking process is observed.

## Sealing of Samples

Division and sealing carried out in full view of vendor; allowed to verify identity of labels attached to the three portions which should accurately describe article and bear identification number and date. Corks pushed in neck of bottle, protruding portion cut off, covered with sealing wax and seal applied. Anything which cannot be effectively sealed in this manner enclosed in envelope and sealed. Container and envelope both labelled. When samples have been divided, marked and sealed, one portion handed to vendor, one retained for subsequent production if necessary and one submitted to Analyst, preferably by officer who purchased same.

When taken in course of delivery, vendor's portion sent by registered post; an enclosure states that sample has been taken for analysis and time and place indicated. Portion of all samples retained by officer should be stored in a cool, dark place, preferably a locked refrigerator.

## Records

Following records to be kept:

(1) Record of samples obtained.
(2) Results of analysis.
(3) Record of legal proceedings.
(4) Card index of food shops.

# INDEX

Abattoirs, 3
Abdomen, 11
*Abnormal colouring of fat*, 25
  odour and *taste*, 25
Abnormalities in milk, 83
*Acaridæ*, 42–46
Accidental death, 48
Actinobacillosis, 32
Actinomycosis, 38
Adulteration of milk, 89
*Aerated waters, 100*
Age, 20
Anæmia, 30
Anatomy, 9
Animal body, appearance of, 9
Ante-mortem inspection, 1
Anthrax, 32
Appearance of animal, 1
  of fresh meat, 8
  of imported meat, 8
Aspergillus pneumonia, 38

Bacillary necrosis, 32
Bacon curing, 54–55
Bacteria in milk, 81–82
Bacterial diseases, 32
  endocarditis, 40
*Badly bled, 25*
Beverages, 100
Black quarter, 33
Blenny family, 65
Blood diseases, 30
  drying, 50
Bone drying, 51
Bones, 10
Bots, 46
Braxy, 33
Bread, 100–101
Butter, 89–90
  milk, 90
By-products of meat, 50–53

Calf diphtheria, 33
Canned foods, 98–100
    general, 98
    imported, 100
    inspection of, 99–100
Canned foods—*continued*
    meat, 53
    methods of canning, 98–99
Carcase inspection, 8
Caseous lymphadenitis, 34
Cattle plague, 38
Cereals, 101
Cestodes, 43–45
Characteristics of fish, 70
Cheese, 90
*Chemical composition* of milk, 80–81
    of milk products, 96
Chitterlings, 51
Choking, 48
*Clean milk production*, 84
Close seasons for fish, 70–71
Cloudy swelling, 48
Coccidia, 47
Cod family, 64
Condensed milk, 91–92
Confectionery, 102–103
Contagious pleuro-pneumonia, 39
Cooked *meats, 51*
  meat premises, 51
Corn, 101–102
Cowshed, 83–84
Cream, 91–92
*Crustaceans*, 78
Cured fish, 71–72
*Cysticercus bovis*, 44
  *cellulosæ*, 44
  *tenuicollis*, 44

Dairy, 84
Defects in eggs, 104–105
Degenerative conditions, 48
Designated milk, 84–85
*Digestion*, 2
Diseases caused by milk, 83
  of fish, 72–74
  of game, 62
  of poultry, 57–60
  of rabbits, 61–62
*Distoma hepaticum*, 45–46
Division of food samples, 115, 117
*Dressing calves, sheep, pigs*, 7
  carcases, 6

Dried fruits, 103
milk, 92–93
Drowning, 49
Drying meat, 54
Ductless glands, 13
Dystopia, 49

*Echinorynchus gigas*, 42
Eel family, 67, 69
Eggs, 103–104
Emaciation, 25
Endocarditis, 26
Enteritis, 26
Equipment for food sampling, 114
Evaporated milk, 93–94
External parasites, 46–47

FAT, melting, 51
Fatty degeneration, 48
infiltration, 48
Feathered game, 62
Fermented liquors, 105
milks, 94
Fever, 27
Fish, anatomy of, 63
blenny family, 65
characteristics of, 70
close seasons, 70–71
cod family, 64
cured varieties, 71–72
diseases of, 72–74
caused by shellfish, 78, 79
eel family, 67
flat varieties, 67–69
food value, 70
fresh water varieties, 69, 70
general, 63
herring family, 66
inspection of, 72
keeping qualities, 70
mackerel family, 65
mullet and gurnard family, 65
preservation of, 74–76
round varieties, 64
salmon family, 66
salt water varieties, 64
sea bass family, 65
shellfish, 76–79
sturgeon family, 67
types of, 64
Flat fish, 76
Flour, 101–102
Food animals, differentiation, 22–23
Food poisoning, causative organisms, 111
foods affected, 112
investigations, 112
mode of infection, 112
symptoms, 111–112
sampling, division of samples 115, 117
equipment, 114
objects of, 114
purchase of samples, 114
quantity required, 116
records, 117
sampling required, 114
sealing of samples, 117
value of fish, 70
Foot and mouth disease, 39
Fresh meat, 8
water fish, 69
Fruit, 105–107
Fungus diseases, 38
Furred game, 62

GAME, diseases of, 62
feathered, 62
furred, 62
general, 62
Gelatine, 51
Generative organs, 3, 15
Glanders or farcy, 34
Glands, 17
of ox and sheep, 18–19
of pig, 20
Glandular products, 52
Glossary of terms, 23–25
Glossitis, 27
Gurnard family, 65
Gut scraping, 52

HEART, 16
Hepatitis, 27
Herring family, 66
Homogenisation of milk, 86
Hydatid cysts, 45
Hydræmia, 30

ICE cream, 94–95
Immaturity, 25
Imported canned foods, 100
meat, 8, 49
inspection of, 49–50
Inflammatory diseases, general, 26
Inflation of carcases, 7
Injuries, 3

Inspection of canned foods, 99–100
of carcases, 8
of fish, 72
of milk plant, 87–88
Intestines, 13
Irradiation of milk, 87

JAUNDICE, 30
Jewish method of slaughter, 5
Johne's disease, 34
Joint ill, 40

KEEPING *qualities of fish, 70*
Kidneys, 15

LABORATORY control of milk, 88–89
Lard, 52
Larynx, 15
Leucocythæmia, 30
Liver, 14
flukes, 45–46
Louping ill, 34
Lungs, 15
Lymphatic system, 17

MACKEREL family, 65
Maggots, 46
Malignant catarrh, 39
œdema, 35
Mammitis, 27
Margarine, 95–96
Meat, by-products, 50–53
digesting, 52
preservation of, 53–55
Melanosis, 48
Mesentery, 13
Methods of canning, 98–99
Milk, abnormalities in, 83
adulteration of, 89
bacteria in, 81–82
chemicalcharacteristics, 80–81
clean milk production, 84
condensed, 91–92
cowshed, 83–84
dairy, 84
definition, 80
*designated types, 84–85*
diseases caused by, 83
dried, 92–93
evaporated, 93–94
fermented, 94
fever, 28
general, 80
homogenisation of, 86–87

Milk—*continued*
inspection of plant, 87–88
irradiation of, 87
laboratory control, 88–89
pasteurisation of, 85–86
processing of, 85–87
sediment in, 83
spots, 30
stassanisation of, 87
sterilisation of, 87
products, butter, 89–90
butter milk, 90
cheese, *90*
chemical composition, 96
condensed milk, 91–92
cream, 91
dried milk, 92–93
evaporated milk, 93–94
fermented milks, 94
ice cream, 94–95
margarine, 95–96
various, 97
whey, 97
vitamins in, 81
Molluscs, 76, 77
Mouth, 11
Mullet family, 65

NAVEL ill, 40
Necrosis, 28
Nematodes, 42–43
Nephritis, 28
Nuts, 107

OBJECTS of meat inspection, 1
Œsophagus, 11
*Œsophagustomum columbianum*,
Offal, 13
Omentum, 13
Onchocerciasis, 42
Osteomyelitis, 41
Ostitis, 28
Other milk products, 97

PANCREAS, 13
Parasites, cestodes, 43–45
*definition, 41*
external, 46–47
nematodes, 42–43
other types, 47
trematodes, 45–46
Pasteurisation of milk, 85–86
Pericarditis, 29
Peritonitis, 29

Pharynx, 11
Physiological conditions, 25
Physiology, 9
Pickling, meat, 54
Pleurisy, 29
Pluck, 13
Pneumonia, 29
Poorness, 26
Portal circulation, 17
Poultry, anatomy, 56
  characteristics, 56–57
  diseases, bacterial, 57–58
    due to parasites, 59–60
      to viruses and fungi, 58–59
    miscellaneous, 59
    of the blood, 59
  general, 56
  killing and plucking, 57
  packing, 57
Preservation of eggs, 104
  of fish, 74–76
  of meat, 53–55
Preserves, 107
Private slaughterhouses, 3
Pulmonary system, 17
Pulse, 2
Pulses, 110
Purchase of food samples, 114

Rabbits, differentiation from cat, 60
  diseases of, 61–62
  general, 60
  inspection, 61
Red water, 47
Refrigeration, meat, 54
Respiration, 1
Rheumatism, 30
Rickets, 31
Rigor mortis, 8
Round fish, 64

Salmon family, 66–69
Salting, meat, 54
Sampling of food, 114
Sapræmia, 41
Sarcosporidia, 47–48
Sausages, 53
Sea bass family, 65
Sediment in milk, 83
Septic mastitis, 41
  metritis, 41
Sex, distinguishing features, 21–22
Sheep-pox, 35
Shellfish, 76–79
  diseases caused by, 78, 79
Slaughterhouses, 3
Slaughtering calves, sheep, pigs, 6
  and dressing, 4
  general, 4
  Jewish method, 5
Smoking, meat, 55
Spleen, 14
Stassanisation of milk, [illegible]
Sterilisation of milk, 87
Stillborn, 26
Stomach, 12
Strongyli, 42–43
Stunning, 4
  and bleeding, 5
Sturgeon family, 67
Suffocation, 49
Sugar, 107–108
Suppurative diseases, general, 40
Swine erysipelas, 35
  fever, 40
Systemic circulation, 17

Tænia, 45
Teeth, 20
Temperature, 2
Tetanus, 35
Thorax, 11
Tongue, 11
Trachea, 15
Trematodes, 45–46
*Trichina spiralis*, 43
Tripe, 53
Tuberculosis, 36–37
Tumours, 31

Udder, 3
Uræmia, 31
Urinary system, 14
Urine, 2
Urticaria, 37

Vegetables, 108–110
Vinegar, 110
Virus diseases, 38
Vitamins in milk, 81

Warbles, 47
Whey, 97

PRINTED IN GREAT BRITAIN BY THE WHITEFRIARS PRESS LTD.
LONDON AND TONBRIDGE